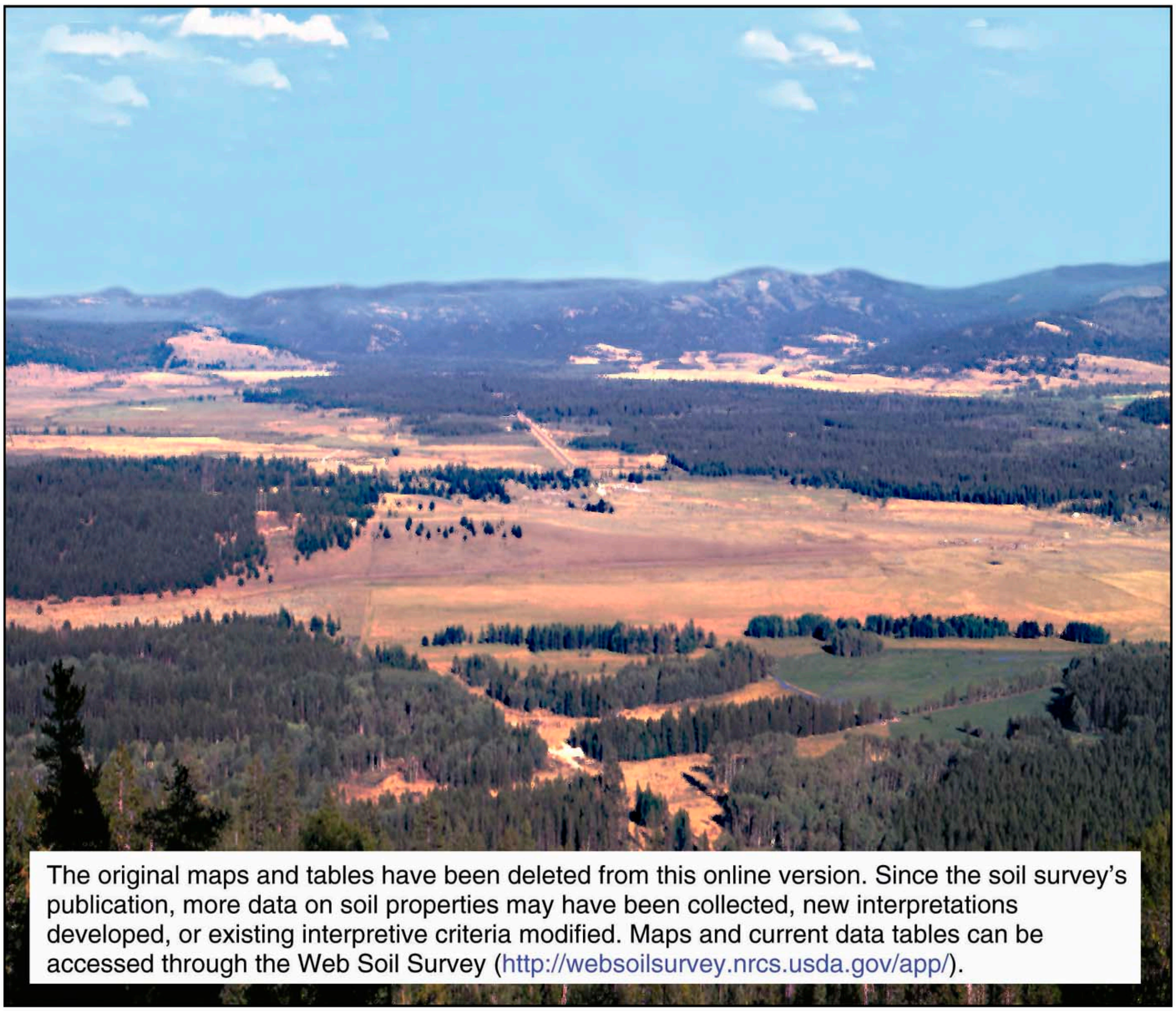
United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the Montana Agricultural Experiment Station

MT630—Soil Survey of Lewis and Clark County Area, Montana

Part I



The original maps and tables have been deleted from this online version. Since the soil survey's publication, more data on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. Maps and current data tables can be accessed through the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/).

How to Use This Soil Survey

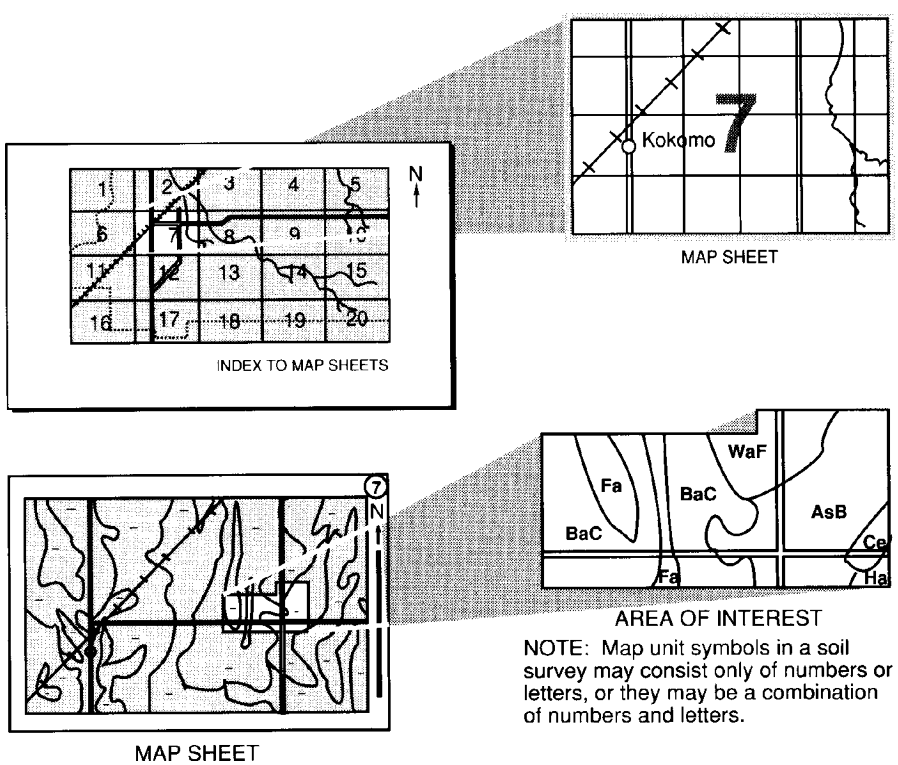
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, you can locate the Section, Township, and Range by zooming in on the **Index to Map Sheets**, or you can go to the Web Soil Survey at (http://websoilsurvey.nrcs.usda.gov/app/).

Note the map unit symbols that are in that area. The **Contents** lists the map units by symbol and name and shows the page where each map unit is described.

See the Contents for sections of this publication that may address your specific needs.



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Lewis and Clark Conservation District. Financial assistance was provided by the Old West Regional Commission through the Montana Department of State Lands and the Montana Association of Conservation Districts.

The most current official data are available through the NRCS Soil Data Mart website at http://soildatamart.nrcs.usda.gov. Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: View of the Lincoln Valley area in the western part of Lewis and Clark County. The soils in this area are used mainly for woodland, rangeland, and irrigated hayland.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

Contents

Part I

Part II

Issued 2003

Index to Taxonomic Units

Index to Map Units

Summary of Tables

For tables with the most current data, please visit the
Soil Data Mart at **http://soildatamart.nrcs.usda.gov/.**

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Dave White
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Lewis and Clark County Area, Montana

Fieldwork by Lamonte C. Bingham, Mervyn H. Haub, Patrick E. McCain, and
J. Art Olsen, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
the Montana Agricultural Experiment Station

LEWIS AND CLARK COUNTY AREA is located in west-central Montana (fig. 1). The survey area consists of all of the land in Lewis and Clark County except federal land within the Helena and Lewis and Clark National Forests. Included in this survey are approximately 12,000 acres south of Helena and several thousand acres of privately owned land within national forest boundaries. The survey area includes 1,223,900 acres and covers approximately 1,912 square miles.

Helena, in the extreme southern part of the survey area, is the county seat and capital city of Montana. The Continental Divide and the main range of the Rocky Mountains extend through the western section of the survey area. Part of the survey area extends west of the Continental Divide to include the town of Lincoln, the Lincoln Valley, and some of the surrounding mountains. The southern boundary is just north of the Elkhorn Mountains. The Big Belt Mountains are along the eastern boundary. The northern boundary is the Sun River and its North Fork. From the southeastern corner, the Missouri River flows through the survey area in a northerly direction and leaves the survey area south of the town of Craig. Canyon Ferry, Hauser, and Holter Dams have been constructed on the Missouri River. Each dam has created a large reservoir.

The survey area includes about 60 percent rangeland, 25 percent woodland, 10 percent cropland, and 5 percent urban or built-up areas. The main economic enterprises are farming, ranching, logging, and mining. The main agricultural crops are wheat, barley, alfalfa hay, grass hay, and pasture.

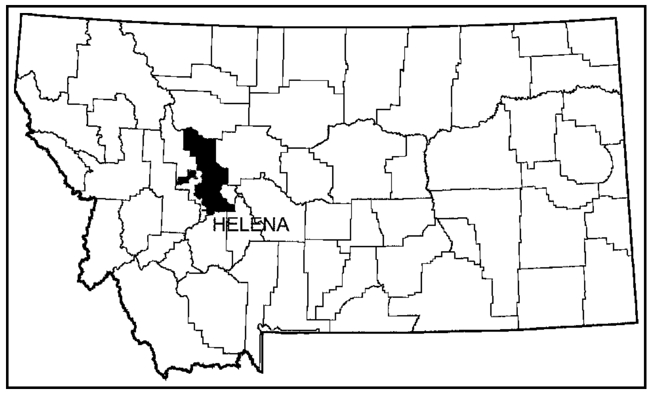


Figure 1.—Location of Lewis and Clark County Area, Montana.

Elevation in the survey area ranges from about 3,500 to 7,800 feet. Mean annual precipitation ranges from 10 to 30 inches. Mean annual air temperature ranges from 34 to 45 degrees F, and the frost-free period ranges from 50 to 120 days.

This soil survey updates the “Soils of Lewis and Clark County: Soil Reconnaissance of Montana” (USDA, 1947). The present survey provides additional information and has larger maps that show the soils in greater detail.

General Nature of the Survey Area

This section describes some of the environmental and cultural features that affect the use and management of soils in the survey area. These features are history; industry, transportation, and

recreation; water resources; physiography, drainage, and geology; and climate.

History

On July 19, 1805, Captain Meriweather Lewis ascended the Missouri River into the area covered by this report. In his journal, he described an area along the river, giving it the name "Gates of the Mountains" by which it is still known. His partner, Captain William Clark, traveled overland, accumulating data in his journal. Many of his descriptive names continue to be used today. The association with these famous explorers resulted in the name of Lewis and Clark County.

The Lewis and Clark County Area was used as hunting grounds for the Blackfeet Indian Tribe. Trapping and trading were the major industries of the survey area until 1864 when placer gold was discovered in the Helena area and the Elkhorn and Big Belt Mountains. Gold-bearing quartz veins were also discovered at this time but were not extensively worked until transportation facilities were developed.

The history of agriculture in the survey area began simultaneously with the first discovery of gold. In the early 1860s, many immigrants moved to Montana for mining but discovered no claims were available. As a second choice, they turned to farming and raising livestock. In the early 1870s, the first livestock arrived in the Sun River and Helena valleys from Fort Shaw, Montana. At about the same time, sheep were trailed in from the Oregon Territory. Land taken up by early stockmen was mainly bottomland that had access to water. This land was suitable for pasture, production of wild hay, and winter grazing.

In 1875, as a result of action by the Territorial Legislature, Helena became the capital of the Montana Territory. In 1889, Helena became the capital of Montana.

Public domain land was largely under control of stockmen and miners until the national forests were created. In approximately 1906, various state agencies began developing the agricultural resources of Montana. Because of favorable climatic conditions for crop production, these agencies were instrumental in establishing large portions of public domain land for farming. Land filed upon under the Homestead and Desert Acts was in the foothills and intermountain basins. Much land was placed under cultivation between 1908 and 1915. However, many of these areas were poorly suited to cultivation and were soon abandoned or seeded back to grass. Farmers and ranchers soon learned the importance of irrigation. By diverting water into usually low-producing areas, they were able to produce crops with assured success.

Industry, Transportation, and Recreation

The main industries in the survey area include livestock, farming, logging, and small mining operations. Helena also contains numerous small businesses and employment opportunities for government employees.

The livestock industry is mainly cow-calf operations and accounts for about 75 percent of farm and ranch income. The main crops grown on nonirrigated land are winter wheat and spring wheat. The main crops grown on irrigated land are spring wheat, barley, alfalfa, grass for hay, and pasture.

Public stockyards in the towns of Bozeman, Butte, and Great Falls provide good livestock marketing facilities. Cattle and sheep are sold both locally and out of state. Most wheat produced is transported out of state by truck or rail. Alfalfa hay and grass hay are used mostly for local livestock.

Several trucking firms, located in Helena, provide transportation services. The Burlington Northern Santa Fe and Montana Rail Link provide railroad service to the survey area and facilitate shipment of freight to eastern and western markets.

The survey area contains a good system of highways and roads. U.S. Highway 12 parallels the Montana Rail Link through the southern portion of the survey area. Interstate 15 enters the county about 15 miles south of Helena and parallels the Burlington Northern Santa Fe to Great Falls. U.S. Highway 287 travels north from Interstate 15, near Wolf Creek, to Augusta in the northern part of the survey area. State Highway 279 leaves Interstate 15 just north of Helena, travels northwest over Flesher Pass on the Continental Divide, meeting State Highway 200 in the western part of the survey area. Highway 200 travels west through the town of Lincoln before exiting the county. From the junction of Highways 200 and 279 east of Lincoln, Highway 200 travels northeast over Rogers Pass on the Continental Divide, through the central part of the survey area, and exits the county near the town of Simms. U.S. Highway 21 travels east from Augusta, following the Sun River in the northern part of the survey area and exiting the county near Simms. Other secondary highways and county roads also provide good vehicular traffic throughout the survey area.

Recreational opportunities abound. The surrounding mountains provide for activities such as camping, fishing, hiking, hunting, and sightseeing. The mountains contain many big game species and

upland game birds. Many streams and reservoirs in the survey area provide excellent fishing and other water-related activities.

Water Resources

Many perennial streams provide a limited amount of water for irrigation and other uses. Water from Prickly Pear Creek, Ten Mile Creek, and the South Fork of Little Prickly Pear Creek is used for irrigation in the southern part of the survey area.

Water is taken from below Canyon Ferry Dam to irrigate land in the Helena Valley. The U.S. Bureau of Reclamation built this project, called the Helena Valley Unit. It provides irrigation water for approximately 15,000 acres of land. The pumping plant consists of two hydraulic turbine-driven centrifugal pumps and is located about 500 feet downstream from Canyon Ferry Dam. Each pump is designed to pump 150 cubic feet per second, at a total head of 145 feet. Reservoir water is lifted to the Helena Valley Tunnel and flows, by gravity, through the Helena Valley Canal to the regulatory reservoir on the east side of the valley. This reservoir has a 10,600 acre-feet capacity. From the regulatory reservoir, water flows into a canal that runs around nearly the entire bowl-shaped valley. The diversion and storage works of the Helena Valley Unit also provide municipal and industrial water to Helena.

Water from the Missouri River irrigates some small areas below Holter Dam. The Dearborn River provides a limited amount of water to irrigate the central part of the survey area. The Dearborn Canal diverts water from the North Fork of the Dearborn River into the headwaters of Flat Creek. Several thousand acres along Flat Creek are irrigated with this water.

In the northern part of the survey area, water is diverted from Ford and Smith Creeks and is stored in the Nilan Reservoir, located about 7 miles southwest of Augusta. From this project, several thousand acres are irrigated along the Elk, Smith, and Willow Creeks near Augusta. The Sun River also provides some irrigation water.

The Blackfoot River and some of its tributaries in the western part of the survey area provide a limited amount of water to irrigate several hundred acres in the Lincoln Valley.

Ground-water information for much of the survey area is limited. Good quality water probably exists in the alluvium of the many mountain valleys. Cretaceous aquifers in the northeastern portion of the survey area are known to contain water, but it is of variable quality. Water from Quaternary deposits is generally good quality, with wells often producing up to 60 gallons per minute.

The depth to ground water in the Helena Valley area ranges from 10 to 400 feet. It is estimated that 150,000 acre-feet of good quality water is stored in the deep alluvium of the Helena Valley. Some artesian wells flow at rates of up to 125 gallons per minute, while maximum rates for pumped wells are as much as 1,000 gallons per minute.

Most stream valleys throughout the survey area have enough coarse alluvium to produce adequate quantities of water for domestic use. Areas underlain by hard rock will commonly produce enough water for both domestic and livestock use since deformation by folding and faulting have created fracture pockets that retain water. A small amount of poor quality water is available in areas that are underlain by Cretaceous shales and mudstones.

Physiography, Drainage, and Geology

Clifford A. Balster, Geologist, prepared this section.

Most of the survey area lies in the Northern Rocky Mountain physiographic province. However, the far northeastern corner of the survey area is assigned to the Northern Great Plains Province. Between these two provinces is an area known as the Disturbed Belt. A transition area of foothills, it is characterized by complex folding and faulting related to the Rocky Mountain deformation. In reality, it is a separate physiographic province but is traditionally included in the Northern Rocky Mountain Province.

The Continental Divide defines several miles of the survey area's boundary and then trends northwestward. The survey area boundary again follows the Continental Divide, northward from Twin Peaks, to the northern end of the county. Mountainous terrain is characteristic of both sides of the Continental Divide.

Not included in this soil survey were most of the Rocky Mountains that are located north of Silver King and Red Mountains. Nearly all of the Big Belt Mountains were also excluded. However, wherever discussion of topography and drainage can be enhanced by including descriptions of these areas, they will be briefly described.

Except for the northeastern corner, most of the survey area is mountainous. West of the Missouri River, numerous linear mountain ranges were formed when large fault blocks were thrust upward and eastward from the west and over other blocks. Where these fault blocks dip steeply westward and are comparatively thin, the ranges are narrow and

separated by equally narrow intervening valleys. Many of these ranges have steep, eastern slopes and gentler, western slopes. Where fault blocks are thicker, or the westward dip is smoother, the ranges are wider and less linear. Narrow linear mountain ranges are more typical of the northern part of the survey area while broader ranges generally occur in the southern part. East of the Missouri River, very broad thrust blocks and poorly defined ranges characterize the Big Belt Mountains.

Narrow ranges of hills and intervening valleys characterize the Disturbed Belt, which borders the mountains on the northeast. Most of the hills and valleys have a northwestern-southeastern trend. Because of erosion factors, they are much more subdued than mountains to the west.

Northeast of the Disturbed Belt, buttes, mesas, and rolling hills are characteristic topography. The boundary between the Northern Great Plains and the Disturbed Belt lies along a southeastward-trending line through the Willow Creek Reservoir and Augusta.

Since the survey area straddles the Continental Divide, drainage flows toward both the Pacific Ocean and the Gulf of Mexico. The Missouri River and its tributaries drain the largest section of the survey area. Of the Columbia River system, both the Blackfoot and South Fork of the Flathead Rivers and tributaries are on the west side of the Continental Divide and carry waters westward to the Pacific Ocean. Each of these major drainages will be discussed later.

Several dams in the survey area impound waters of the Missouri River. Holter Dam forms Holter Lake; Hauser Dam impounds waters of Hauser Lake and Lake Helena; and Canyon Ferry Dam results in Canyon Ferry Lake. These lakes occupy many miles of the Missouri River's relatively narrow valley floor.

Canyon Ferry Lake, at the bottom of the Missouri River valley, enters the survey area in the southeastern corner. Below Canyon Ferry Dam, the Missouri River flows through a narrow canyon which, in places, is up to 500-feet deep. The valley widens as it exits the Spokane Hills. Near Lakeside for a short distance, the valley is broad with low relief but again becomes narrow and canyon-like within a mile below Lakeside. Just below the mouth of Trout Creek, mountains rise about 900 feet above water level. The valley widens briefly near Eldorado Bar but again becomes a canyon, about 1,000-feet deep, until it widens at Upper Holter Lake. The surrounding hills are about 100-feet high at the lower end of Upper Holter Lake, forming the well-known “Gates of the Mountains.” The canyon gradually broadens downstream but never becomes a wide river valley with extensive flood plains and terraces until after it leaves the survey area.

Trout, Beaver, Elkhorn, Cottonwood, Wegner, and Stickney Creeks all head in the Big Belt Mountains. These creeks are small tributaries of the Missouri River and join the river from the east.

The Sun River and its tributaries drain most of the northern part of the survey area. The Sun River marks the northern boundary of the survey area and empties into the Missouri River in Cascade County at Great Falls. Fool and Open Creeks join the North Fork of the Sun River in the northern tip of the survey area. Lick, Gates, Rock, and Moose Creeks are major tributaries from the west. They flow into the North Fork of the Sun River as it flows southward along the survey line. The Sun River and the South Fork of the Sun River and its tributaries drain many square miles of mountainous terrain before joining the North Fork of the Sun River about a mile above Gibson Reservoir. Major tributaries of the South Fork of the Sun River are the West Fork of the Sun River and Straight and Wood Creeks. Dry, Elk, and Willow Creeks also join the Sun River before it leaves the survey area.

Scapegoat Mountain is a prominent feature on the Continental Divide. On its north side, a narrow divide separates drainage waters of Straight Creek, which flows northward to the Sun River, from the Dearborn River, which flows eastward for a few miles, then southeastward between Grassy Hills and Steamboat Mountain in a well-defined valley. The Dearborn River again changes course to flow eastward and northeastward before leaving the mountains near Bean Lake. After leaving the mountains, it flows generally southeastward and joins the Missouri River in Section 19, Township 16 North, Range 2 West. Major tributaries of the Dearborn River are Falls and Flat Creeks and Middle and South Forks of the Dearborn River.

Several small tributaries of the Missouri River drain the survey area south of the Dearborn River system. Little Prickly Pear Creek drains a sizable area between the Dearborn River system and Prickly Pear Creek drainage. McClellan and Prickly Pear Creeks both flow into Lake Helena. Spokane Creek drains a small region in the southeastern corner.

West of the Continental Divide, the Blackfoot River and the South Fork of the Flathead River provide drainage. The South Fork of the Flathead River drains a small section in the western part of the survey area where Danaher Creek and its tributaries drain a small basin south of Sugarloaf Mountain. The Blackfoot River system drains the greater part of the survey area west of the Continental Divide.

Anaconda and Beartrap Creeks join in the northeastern corner of Section 28, Township 15 North, Range 6 West, and form the headwaters of the Blackfoot River. Major tributaries joining the Blackfoot River before it leaves the survey area are Cadotte, Humbug, Keep Cool, and Poorman Creeks and Landers Fork. The North Fork of the Blackfoot River drains a sizable area southwest of Scapegoat Mountain before leaving the survey area to join the Blackfoot River. Principal tributaries of the North Fork of the Blackfoot River are the Dry and East Forks.

Tributaries of the Little Blackfoot River drain a small area in Township 11 North, Ranges 6 and 7 West. Dog Creek and its tributaries drain almost all of this area, though Ophir Creek does flow from a small basin west of the Dog Creek drainage.

In general, streams of the survey area tend to follow geologically or structurally defined trends. They commonly cut across major trends, however, and in places seem entirely unrelated to any identifiable geologic feature.

The geology of lithified rocks in the survey area can be conveniently divided into five major provinces. Relatively flat-lying or gently folded rocks of Cretaceous age are mapped in the northeastern corner of the survey area. Thrust-faulted and complexly folded Cretaceous rocks of the Disturbed Belt border flat-lying sediments toward the southwest and are transitional to imbricated thrust sheets of the older rocks in mountain ranges. Imbricated thrust sheets are generally comprised of rocks from the Jurassic and Mississippian Ages and older, though some areas of Cretaceous sedimentary rocks and Tertiary-Cretaceous igneous rocks are mapped. Westward of the imbricate thrusts is a province of broadly folded rocks ranging in age from Precambrian to Mississippian. Faulting is present in this province but not as complex as the area of imbricate faulting. Normal faults are more common in the western province than in the overthrust belt. The Big Belt Mountains belong to the broadly folded and faulted province. Volcanic rocks, both intrusive and extrusive, comprise the fifth geologic province. Adel Volcanics of early-Tertiary age are extensive in the northern part of the Big Belt Mountains. Small outcrops of Tertiary intrusive rocks are mapped throughout the survey area, and some areas of Tertiary-Cretaceous intrusives are mapped in the imbricate thrust belt. Intrusive rocks of Precambrian age are mostly located in the province of broad folding, but some outcrops are mapped in imbricate thrust sheets.

Precambrian sedimentary rock types of the Belt Supergroup include argillite, quartzite, siltite, and some limestone. All Precambrian lithologies show the result of metamorphism and are remarkably resistant to erosion.

Other than the basal Flathead Sandstone, Cambrian rocks are almost entirely limestone and shale. Some dolomite is present, and many of the limestones are more or less dolomitic. Limestone of this sequence is generally somewhat resistant to erosion and forms ridges, but the shales typically erode to make valleys. Flathead Sandstone is the most resistant lithology of the Cambrian section.

Dolomite is the dominant lithology of the Devonian sequence, but some shale and mudstone occur in both the lower and upper units. Some evaporites are present at depth but generally do not persist at the outcrop. Dolomites of the Devonian sequence are expressed topographically as ridges. The shaly sections at the bottom and top of the sequence erode more readily and tend to form small valleys or covered areas at the outcrop.

Carbonate rocks of the Mississippian age range from shaly limestone and dolomite to massive, thick sections of limestone. Almost without exception, the Mississippian outcrops form prominent ridges or massive hills. Elongated ridges or walls of Mississippian carbonates are characteristic of imbricate thrust areas. Total thickness often exceeds 1,000 feet and produces the high relief generally associated with Mississippian terrain.

Jurassic rocks are mixtures of marine and nonmarine rocks that include shales, sandstones, mudstones, and some limestones. Rarely do any of the lithologies achieve sufficient thickness or resistance to erosion to form prominent ridges. Volcanic activity in the region produced some tuffaceous rocks in the Morrison Formation (youngest of the sequence).

Sedimentary rocks of Cretaceous age are mostly shales, mudstones, and sandstones, but some tuffaceous rocks occur south of Augusta. Most Cretaceous lithologies are not adequately erosion resistant to form high-relief topography, but steep slopes are not uncommon along the margins of the sandstone-capped mesas or buttes. Nonmarine conditions are recorded in early sediments of the Cretaceous age, but throughout the period, alternating marine and nonmarine rocks were deposited. By the end of Cretaceous time, nonmarine beds were dominant, and volcanic materials became more prominent in the lithologies.

Tertiary sedimentary rocks are not major constituents in the survey area. Very small areas of lake deposits of Oligocene and Miocene ages are mapped west of the Missouri River. An extensive area

of tuffaceous conglomerate, sandstone, siltstone, and shale of undesignated Tertiary age is mapped south of Lake Helena to the survey line. Some parts of the uppermost Cretaceous St. Mary River Formation are of Paleocene (lowest Tertiary) age, but the boundary between Cretaceous and Paleocene is obscure.

Pleistocene deposits include gravels on high-level terraces, lake deposits, glacial drift, and morainal materials. Some of the high-level gravels have been assigned a Pliocene age (late Tertiary) but most likely should be considered only as Pleistocene. All the Pleistocene materials are unconsolidated or poorly consolidated and are very difficult to separate from Holocene deposits. Only the most recent alluvial sediments can clearly be called Holocene age, as glaciation in the higher mountains continues to the present time.

Geologic structure in the survey area has been generally discussed with the description of geology because the relationship between the two is almost inseparable. A large linear syncline, known as the Continental Divide Syncline, is well named as it exposes resistant Precambrian rocks that form the backbone of the continent. This syncline is bordered on the east by a thrust fault. The block may have been thrust a long distance over underlying rocks, representing the westernmost thrust sheet of the survey area. Immediately east of the Continental Divide Syncline and its bounding fault, a series of closely spaced imbricate thrust sheets extend to the mountain front and into the Disturbed Belt. Resistant rocks of Mississippian age and older cause the mountains to stand in high relief. Nonresistant rocks of Cretaceous age form the more subdued topography of the Disturbed Belt. Southward from the Continental Divide Syncline, rocks are broadly folded and sparsely faulted, but their resistant character results in mountainous topography. Structure in the Big Belt Mountains fits most closely into the latter province, but broader and better-defined folds characterize it.

The Lewis and Clark County Area has produced mineral resources valued at over $40 million. About $6 million of this was gold produced from placer deposits. Major metallic resources were gold, silver, copper, lead, and zinc. Minor production of tungsten and arsenic has been reported. Indications supporting the occurrence of bismuth, tin, molybdenum, manganese, and antimony have also been reported. Production of nonmetallic resources has been limited to sapphires, present in placer deposits on the eastern side of the Missouri River Valley. Minor occurrences of barite and fluorite have been reported, but their significance is unknown.

Little interest in oil exploration has been shown except, in the late 1970s, in the northern part of the Disturbed Belt. This interest was short-lived and resulted in little activity. A disappointing deep test was drilled near Marysville in search of potential geothermal energy. The outlook for future exploration interest is unknown.

Baxendale, Peeler, and Woodgulch soils are restricted to the hills and mountainous areas in the southern part of the survey area. Granitic rocks of Cretaceous age provide parent material for these soils. Peeler soils formed in material derived from granitic rock. Baxendale and Woodgulch soils formed in residuum weathered from granitic rocks. All three soils have clay-enriched B horizons that reflect some degree of landscape stability for an extended period. No calcareous horizons are present in these soils.

Colluvium and alluvium from argillite, igneous, and limestone rocks provide parent material for the Helmville, Stemple, and Tigeron soils. Much of the mountainous terrain in the western part of the survey area is mantled by these soils. Helmville soils formed in colluvium and alluvium derived from limestone, argillite, and igneous rocks. Stemple and Tigeron soils formed in colluvium derived from argillite of the Belt Supergroup and from igneous rocks ranging in age from Precambrian to Tertiary. These two soils are typically located on strongly sloping to very steep slopes. All three soils have clay-enriched B horizons and occur on mountainous terrain. Perhaps high rates of infiltration and mobile clays contribute to the rapid translocation of materials while water moves through the soil.

Argillite, quartzite, and siltite of the Belt Supergroup, and fine-textured rocks of the Adel Volcanics (Tertiary), provide most of the parent material for Holter, Mocmont, and Tolex soils. Minor amounts of Cretaceous sedimentary rocks and Mississippian carbonates and shales crop out and additionally contribute to the parent material for these soils. Holter and Mocmont soils developed in colluvium derived from igneous bedrock and argillite of the Belt Supergroup. Some contribution is by fine-textured rocks of the Adel Volcanics. Tolex soils formed in material derived from Belt Supergroup argillite and igneous bedrock.

Castner, Holter, and Windham soils are in areas with mixed lithologies of bedrock providing the parent material. Castner soils developed in shallow residuum weathered from argillite, quartzite, and

sandstone. Colluviums derived from argillite and igneous bedrock are the parent material for the Holter soils. Windham soils formed in colluvium and alluvium derived from limestones of the Mississippian, Devonian, and Cambrian ages.

A small area of Crow and Mikesell soils is mapped in the mountains and foothills south of Lincoln. Tertiary shales, mudstones, and alpine till provide parent material for these soils. In addition, Belt Supergroup quartzite from nearby areas contributes a minor amount to the parent material.

The Worock and Yourame soils occur in the glaciated mountainous terrain near Lincoln. Worock soils developed in alpine till derived from Belt Supergroup rocks and rocks ranging in age from Tertiary to Precambrian. Yourame soils formed in alpine till in glaciated valleys of the survey area.

Farnuf, Hilger, and Silvercity soils are mapped near Lincoln. Alluvium and glacial till are the parent material for these soils. Farnuf soils are loamy textured. The Hilger and Silvercity soils are loamy textured with more than 35 percent coarse fragments of mostly igneous rock and quartzite.

Beanlake, Fairfield, and Winspect soils occur in the northwestern part of the survey area. Beanlake soils developed on extensive glacial moraines in loamy materials of mixed mineralogy. Fairfield soils formed on alluvial fans and moraines near the mountains from parent material with significant amounts of limestone. Parent material for Winspect soils is calcareous alpine till derived from limestone, dolomite, sandstone, and argillite from the mountains to the west. Limestone of Devonian and Mississippian ages, argillite of Precambrian age, and sandstone of Cretaceous age are major contributors to the lithologic assemblage of these tills. Glacial sediments on hills are the dominant parent material for all of these soils.

Delpoint and Marmarth soils are mapped in an area east of Augusta, underlain by the Horsethief, St. Mary River, and Two Medicine Formations of Cretaceous age. Sandstone is a subordinate lithology in this section but appears more prominently than expected because it is more resistant to erosion. Delpoint soils developed from sandstones and siltstones that were originally calcareous. Parent material for the Marmarth soils are sandstone, siltstone, and shale. Marmarth soils are on gently sloping to moderately steep slopes of sedimentary plains and hills and seems to reflect landscape stability because of clay-enriched B horizons.

Cretaceous rocks of the Horsethief, Marias, St. Mary River, Two Medicine, and Virgelle Formations provide parent material for the Cabba, Reeder, and Regent soils. As mentioned above, sandstone is a subordinate constituent of this sequence. Parts of the Two Medicine Formation also have abundant volcaniclastic materials, some of which are flows. Much of the area where these soils are located is complexly thrust-faulted and tightly folded. The shallow Cabba soils occur on a variety of slopes, some of them very steep, and are derived from weathered calcareous sandstones. Reeder soils formed from calcareous sandstones, mudstones, and siltstones. Typical landscapes are rolling hills of plains topography with slopes ranging from gently sloping to steep. Regent soils are weathered from shales and mudstones.

Assinniboine, Megonot, and Weingart soils developed in poorly consolidated sediments of Tertiary age or in alluvium derived from these materials. Assinniboine soils formed in alluvium derived from sandy shales and shaly sandstones of Tertiary age. Megonot soils developed in material derived from Tertiary shales and mudstones. Both Assinniboine and Megonot soils are mapped on landscapes ranging from gently sloping to steep. Weingart soils typically occur on gentle slopes on hills and sedimentary plains. These soils developed in material derived from Tertiary shales and mudstones.

Calcareous lake sediments of Pleistocene age are the parent material for Brocko and Chinook soils. These soils are mapped in small areas of dissected uplands that border the Missouri River near Wolf Creek. Originally, the topography was probably undulating; it has since been modified by dissection. Brocko soils formed from silty lacustrine sediments. Chinook soils are derived from sandy lake sediments. Neither of these parent material sediments is consolidated.

The Amesha, Musselshell, and Sappington soils formed in calcareous alluvium of probable Pleistocene age. Some poorly consolidated late-Tertiary sediments may be included in this survey area. Amesha soils developed in strongly calcareous alluvium deposited on nearly level to moderately sloping fans or pediments. Musselshell soils formed in alluvium with a strong component of limestone fragments. Calcareous alluviums containing fragments of igneous and metamorphic rocks are the parent material for the Sappington soils. Sappington landscapes are remnants of old pediments and are generally nearly level to moderately sloping.

The Crago, Geohrock, and Sieben soils are on upland remnants of alluvial fans, pediments, or terraces. Coarse alluvium is the parent material for these soils. Parent material for Crago soils are mostly

limestone fragments. Argillite is the dominant constituent of the alluvium that formed the Geohrock soils. Coarse fragments are a dominant part of the Sieben soils, comprised mostly of argillite and igneous rocks.

Near Augusta and Helena, gravels and sands of low terraces and associated alluvial fans are the parent material for Attewan, Binna, and Nippt soils. Attewan soils occupy positions ranging from nearly level to moderately sloping. These soils developed in alluvium containing 60 to 80 percent pebbles and cobbles. Nippt soils are nearly level to gently sloping and formed in alluvial gravels of argillite and igneous rocks. All three soils are calcareous and reflect the influence of limestone in the alluvium parent material.

The Fairway, Fluvaquents, and Silverking soils are mapped on low stream terraces and flood plains near Lincoln. These soils formed in alluvium, presumably of late-Pleistocene age. Fairway soils developed in finer-textured alluvium than the extremely gravelly Silverking soils. Fairway soils occupy slightly depressed areas on flood plains and drain somewhat poorly. The parent material for these soils may have been strongly influenced by glacial outwash.

The Korell, Rivra, and Ryell soils occur along flood plains and low terraces of major streams in the northeastern part of the survey area. The parent material are alluviums of Holocene or very late-Pleistocene age. Korell soils developed in silty phases of alluvium while Ryell soils formed in the sandy phases. Rivra soils are derived from extremely gravelly channel deposits. All of these soils are well drained.

Fairway, Meadowcreek, and Villy soils occur on flood plains throughout the survey area. The Fairway and Meadowcreek soils have sand, pebbles, and cobbles in the lower part of the profile. These soils are somewhat poorly drained to poorly drained. Villy soils formed in loamy alluvium.

Whenever soils are related to the geology of an area, it must be remembered that many materials were transported before they became parent material. Some materials were moved a short distance while others may have been moved miles. Apparent anomalous mineralogy, or rock content, is often evidence that materials were transported, even though other evidence may be obscure.

Climate

Precipitation in the survey area ranges mainly from 10 to 30 inches per year. Mean annual temperature ranges from 35 to 45 degrees F.

Summers in the survey area are generally quite pleasant with cool nights; moderately warm, sunny days; and very little hot or humid weather. Most summer rainfall occurs as showers or thunderstorms, but steady rains may occur during late spring or early summer. Most summers pass with the highest temperatures failing to reach 100 degrees F. During April and October, frost frequently occurs along the mountain fronts and in valleys. On rare occasions, frost may occur in low-lying areas at any time of the year.

Winters are not as cold as expected for continental locations at this latitude, largely because of Chinook winds for which the survey area is noted. While subzero weather is normally experienced several times during winter, the coldest weather seldom lasts more than a few days at a time. Cold temperatures cease when Chinook winds arrive from the southwest. They can produce sharp temperature rises of 40 degrees F or more in a 24-hour period. As a result of recurring Chinook winds throughout the winter season, snow seldom accumulates to any great depth. The ground is usually bare, or nearly bare, of snow during most of the winter, except in the mountain fronts and higher foothills. On the other hand, invasions of cold air from the polar regions occur a few times each winter. From mid-December to March, sharp temperature falls are observed, from above freezing to below zero, within a 24-hour period.

On the following pages are climate tables for the period 1961 to 1990 for the survey area. The "Temperature and Precipitation" table gives data for the survey area as recorded at Canyon Ferry Dam, Flatwillow, and Helena. The "Freeze Dates in Spring and Fall" table shows probable dates of the first freeze in fall and last freeze in spring. The "Growing Season" table provides data on probable length of the growing season.

Growing-degree days, as shown in the "Temperature and Precipitation" table, are equivalent to heat units. During the month, growing-degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal growing-degree accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

As is usual in areas having wide variations in elevation and irregular topographic features, differences in the amount of precipitation are considerable. Generally, precipitation falls as snow during late fall, winter, and early spring. Rain can occur in any month. Late spring, summer, and early

fall precipitation is almost always rain, but some hail is occasionally observed during summer thundershowers. The wettest areas are along the mountains.

Although the mean annual precipitation would normally classify the survey area as semiarid, it is important to note that about 70 percent of the annual total precipitation normally falls during the April to September growing season. Heavy fog seldom occurs with any frequency and is usually limited to about 1 day per month, with each incident remaining for only a small portion of the day. Although the average windspeed is relatively high, extremely strong winds of over 70 mph are seldom observed. Visibility is normally excellent.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. This information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the survey area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, soil scientists develop a concept, or model, of how the soils were formed. During mapping, this model enables soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates; kind and amount of rock fragments; distribution of plant roots; reaction; and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret data from these analyses and tests as well as field-observed characteristics and soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data for crop yields under high levels of management are modeled and validated with farm records and field or plot information on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of

accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Descriptions, names, and delineations of the soils in this survey area may not fully agree with those of the soils in adjacent survey areas. Differences result from a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Temperature and Precipitation

(Recorded in the period 1961-1990 at Canyon Ferry Dam, Flatwillow, and Helena)

Month	Temperature (Degrees F)					Precipitation (Inches)					
	Average Daily Maximum	Average Daily Minimum	Average	2 years in 10 Will Have— Maximum Temperature More Than	2 years in 10 Will Have— Minimum Temperature Less Than	Average Number of Growing Degree Days*	Average	2 years in 10 Will Have— Less Than	2 years in 10 Will Have— More Than	Average Number of Days With 0.10 or More	Average Total Snowfall
CANYON FERRY DAM:											
January---	31.2	13.3	22.3	54	-24	4	0.54	0.16	0.84	1	0.5
February--	37.7	18.0	27.9	59	-17	10	0.33	0.10	0.52	1	0.0
March-----	46.0	24.0	35.0	67	-6	46	0.57	0.26	0.84	1	1.4
April-----	57.4	32.2	44.8	78	15	176	0.95	0.51	1.33	3	0.6
May-------	67.0	40.1	53.6	86	26	423	1.93	1.03	2.72	5	0.0
June------	76.0	47.9	61.9	93	34	657	1.93	0.94	2.79	5	0.0
July------	84.7	52.5	68.6	98	40	883	1.34	0.47	2.06	3	0.0
August----	83.8	51.5	67.6	98	38	855	1.30	0.57	2.00	3	0.0
September-	71.9	43.1	57.5	90	27	526	1.21	0.44	1.86	3	0.0
October---	59.8	35.2	47.5	80	15	257	0.66	0.20	1.08	2	0.0
November--	44.0	25.8	34.9	65	-1	51	0.48	0.25	0.69	1	0.2
December--	33.6	16.8	25.2	56	-19	10	0.55	0.26	0.80	1	1.2
Yearly:											
Average--	57.8	33.4	45.6	—	—	—	—	—	—	—	—
Extreme--	106.0	-36.0	—	99	-28	—	—	—	—	—	—
Total----	—	—	—	—	—	3,899	11.80	9.14	14.30	29	3.9
FLATWILLOW:											
January---	33.4	9.1	21.3	63	-30	16	0.56	0.18	0.87	1	7.5
February--	40.1	14.9	27.5	68	-21	25	0.34	0.10	0.57	0	4.2
March-----	47.4	21.6	34.5	74	-14	62	0.70	0.35	1.00	2	5.8
April-----	58.9	30.9	44.9	85	8	197	1.28	0.56	1.89	3	4.9
May-------	68.8	39.9	54.4	91	22	448	2.89	1.67	3.97	6	0.8
June------	78.4	48.4	63.4	98	34	697	2.36	1.17	3.39	5	0.0
July------	86.7	53.4	70.1	102	39	923	1.30	0.58	1.92	3	0.0
August----	85.6	51.4	68.5	102	37	881	1.27	0.52	1.97	2	0.0
September-	73.3	42.2	57.7	96	24	530	1.13	0.32	1.85	3	0.5
October---	63.1	33.7	48.4	87	10	295	0.85	0.27	1.33	2	2.1
November--	46.4	21.4	33.9	73	-11	62	0.43	0.14	0.67	1	4.4
December--	36.0	11.8	23.9	65	-29	19	0.50	0.18	0.77	1	6.9
Yearly:											
Average--	59.8	31.6	45.7	—	—	—	—	—	—	—	—
Extreme--	108.0	-41.0	—	103	-34	—	—	—	—	—	—
Total----	—	—	—	—	—	4,156	13.60	0.96	16.11	29	37.2

See footnote at end of table.

Temperature and Precipitation--Continued

Month	Temperature (Degrees F)					Precipitation (Inches)					
	Average Daily Maximum	Average Daily Minimum	Average	2 years in 10 Will Have-- Maximum Temperature More Than	2 years in 10 Will Have-- Minimum Temperature Less Than	Average Number of Growing Degree Days*	Average	2 years in 10 Will Have-- Less Than	2 years in 10 Will Have-- More Than	Average Number of Days With 0.10 or More	Average Total Snowfall
HELENA:											
January---	29.8	9.8	19.8	56	-27	5	0.63	0.21	0.98	1	8.9
February--	37.1	16.0	26.6	61	-19	11	0.42	0.16	0.63	1	5.7
March-----	44.9	22.4	33.6	70	-8	39	0.73	0.37	1.05	2	7.4
April-----	56.0	30.7	43.3	80	14	155	0.97	0.48	1.40	3	5.5
May-------	65.4	39.6	52.5	88	26	391	1.78	0.87	2.56	4	1.7
June------	74.8	47.8	61.3	95	34	638	1.87	0.85	2.75	5	0.1
July------	83.8	52.8	68.3	99	40	878	1.10	0.32	1.74	2	0.0
August----	82.0	51.0	66.5	99	38	822	1.29	0.42	2.01	3	0.0
September-	69.8	41.0	55.4	92	24	467	1.15	0.34	1.80	3	1.6
October---	58.6	31.6	45.1	80	10	201	0.60	0.14	0.96	1	2.2
November--	42.4	20.8	31.6	66	-8	29	0.48	0.22	0.70	1	4.8
December--	31.3	11.3	21.3	58	-28	7	0.59	0.27	0.86	1	8.5
Yearly:	---	---	---	---	---	---	---	---	---	---	---
Average--	56.3	31.2	43.8	---	---	---	---	---	---	---	---
Extreme--	105.0	-38.0	---	101	-32	---	---	---	---	---	---
Total----	---	---	---	---	---	3,644	11.61	8.99	14.08	27	46.3

* A growing-degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold: 40.0 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-1990 at Flatwillow and Helena)

Probability	Temperature		
	24 Degrees F or Lower	28 Degrees F or Lower	32 Degrees F or Lower
FLATWILLOW:			
Last freezing temperature in spring: January-July			
1 year in 10 later than------	May 11	May 25	June 2
2 years in 10 later than-----	May 5	May 19	May 28
5 years in 10 later than-----	April 24	May 9	May 19
First freezing temperature in fall: August-December			
1 year in 10 earlier than----	September 23	September 11	September 6
2 years in 10 earlier than---	September 30	September 17	September 10
5 years in 10 earlier than---	October 12	September 28	September 19
HELENA:			
Last freezing temperature in spring: January-July			
1 year in 10 later than------	April 30	May 12	June 1
2 years in 10 later than-----	April 26	May 7	May 27
5 years in 10 later than-----	April 18	April 29	May 18
First freezing temperature in fall: August-December			
1 year in 10 earlier than----	September 21	September 13	September 5
2 years in 10 earlier than---	September 27	September 18	September 10
5 years in 10 earlier than---	October 8	September 30	September 20

Growing Season

(Recorded in the period 1961-1990 at Flatwillow and Helena)

Probability	Daily Minimum Temperature		
	Higher Than 24 Degrees F	Higher Than 28 Degrees F	Higher Than 32 Degrees F
	Days	*Days*	*Days*
FLATWILLOW:			
9 years in 10	146	118	101
8 years in 10	154	126	108
5 years in 10	170	141	122
2 years in 10	185	156	136
1 year in 10	193	164	144
HELENA:			
9 years in 10	148	131	105
8 years in 10	157	139	112
5 years in 10	172	153	124
2 years in 10	188	167	137
1 year in 10	196	174	143

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification. The tables, “Classification of the Soils” and “Acreage and Proportionate Extent of the Soils,” at the end of this section show the classification and extent of the soils in this survey area.

Formation of the Soils

Soil is a natural, three-dimensional body on the earth’s surface. Soil has properties that result from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over a period of time.

Although there are many different soils, each soil is the result of the interaction of the same five factors. These factors are the effect of climate on the parent material, the kinds of plants and organisms living in the soil, the relief of the land, the physical and chemical composition of the parent material, and the length of time it took for the soil to form.

Within short distances, the combination of these factors varies, and, consequently, the soils that form differ in fertility, productivity, and physical and chemical characteristics. In the following paragraphs, the factors of soil formation are discussed as they relate to the soils in the survey area.

Climate

Temperature and precipitation mainly determine climate, an active force in the formation of soils. Soils form in rocks that have been broken into suitable materials by erosion and alternate freezing and thawing. Chemical reactions, such as solution and hydration, further break down this weathered material.

Precipitation and temperature affect the kind and amount of vegetation that grows on the soil. Vegetation decays to produce organic matter in the soil. Soils that have cool temperatures and high precipitation generally contain more organic matter and are dark colored. Soils that have warm temperatures and low precipitation generally contain less organic matter and are light colored.

Living Organisms

Living organisms are active in the formation of soils. Plants, animals, insects, and microorganisms affect gains or losses in organic matter, plant nutrients, and changes in porosity and structure.

Roots, rodents, and insects penetrate the soil and alter its structure. Microorganisms, chemicals in the soil, and insects change leaves, roots, and entire plants that remain in the surface layer to humus. Fungi and algae also contribute to the decomposition of bedrock. Animals increase porosity by burrowing through the soil and leaving open channels for the movement of water and air. Common rodents in the survey area are gopher and rabbit. Some of the fragments on the surface of terraces, and on many other areas, were dug up by burrowing rodents.

Vegetation in this survey area consists mainly of short and mid grasses, trees, and shrubs.

Topography

Topography, or relief, is determined by glaciation and mountain formation and by the age and resistance of geologic formations to erosion by wind and water. Topography influences soil development through its effect on drainage and runoff. On the eroded uplands of this survey area, runoff water has carved deep valleys with many branches into the original bedrock. This rugged relief contrasts sharply with the smooth low relief of alluvial fans, stream terraces, and the flood plains of river valleys.

Soils on steep slopes that have rapid runoff have many characteristics similar to those of soils formed in arid climates. Nearly level to moderately sloping soils have the characteristics typical for this survey area. Map units 861D and 161E provide good examples of this process. The shallow Castner soils are on the steeper backslopes, and the very deep Farnuf and Shawa soils are on the footslopes and toeslopes. The Castner soil has a thin A horizon and

bedrock at a depth of 10 to 20 inches. The Farnuf soil has a thick, dark A horizon and a well-developed B horizon. The Shawa soil has a very thick dark A horizon.

Parent Material

Soils in this survey area formed from a variety of parent materials. Some soils formed in alluvium that was derived from mixed sources. Other soils formed in material weathered from igneous rocks, limestone, sandstone, or shale. Soils, such as the Blaincreek series, that formed in material derived from igneous rocks are generally loamy and have a high content of rock fragments. Soils, such as the Windham series, that formed in material derived from limestone have a high lime content, as lime is the basic constituent of limestone. Soils, such as the Vebar series, that formed in material derived mainly from sandstone are sandy, as sand is the basic constituent of sandstone. Soils, such as the Regent series, that formed in material weathered from shale are clayey, as clay is the basic constituent of shale. Soils, such as the Havre series, that formed in mixed alluvium derived from sandstone and shale are loamy.

Time

Change taking place in soils over a long period is called soil genesis. As a result of these changes, distinct horizons, or layers, develop in the soils. The length of time that parent materials have been in place and exposed to climate and living organisms is generally reflected in the degree to which the soil profile has developed. The kind and arrangement of these horizons are called soil morphology. These layers are described in terms of chemistry, color, consistence, permeability, structure, texture, and thickness.

Soils are classified according to their approximate age, from young to mature. Age, or maturity, of a soil is generally indicated by the thickness and distinctness of subsurface horizons, content of organic matter and clay, depth to which soluble material is leached, and form and distribution of calcium carbonate and gypsum in the soil.

Havre silt loam, 0 to 2 percent slopes, of the Entisol order, is a young soil on a flood plain adjacent to a stream. This soil contains little organic matter to form an A horizon and no clay accumulation. Little translocation has occurred to form Bt and Bk horizons.

Farnuf soils formed in parent material similar to, but much older than, that of the Havre soils. Farnuf soils formed in alluvium or glacial till, on alluvial fans, and on stream terraces. They are mature soils of the Mollisol order. They contain enough organic matter to have a moderately dark-colored A horizon. They have a distinct clay accumulation in a Bt2 horizon, and nearly all of the carbonates have been leached to a depth of about 19 inches.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1998 and 1999). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table, “Classification of the Soils,” shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol, from *mollis*, meaning soft.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust,* meaning burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustoll (*Argi*, meaning having an argillic horizon or clay accumulation, plus *ustoll,* the suborder of the Mollisols that has a dry climate).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the

subgroup that typifies the great group. An example is Typic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, mixed, superactive, frigid Typic Argiustolls.

SERIES. The series consists of soils within a family that have horizons similar in arrangement in the profile, color, consistence, mineral and chemical composition, reaction, structure, and texture. An example is the Holter series. The soils in the Holter series are loamy-skeletal, mixed, superactive, frigid Typic Argiustolls.

Soil Series and Detailed Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1962). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (Soil Survey Staff, 1999). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class, there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and, consequently, they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all of the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all of the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is

divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Yamacall silt loam is a phase of the Yamacall series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

This survey includes *complexes.* They consist of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Yamacall-Attewan loams, 0 to 2 percent slopes, is an example.

This survey includes *miscellaneous areas*. They have little or no soil material and support little or no vegetation. Rock outcrop-Rubble land is an example.

The “Acreage and Proportionate Extent of the Soils” table in Parts I and II of the manuscript gives the acreage and proportionate extent of each map unit. Other tables (see “Summary of Tables”) give properties of the soils and the limitations, capabilities, and potentials for many uses. Many of the terms used in describing the soils or miscellaneous areas are defined in the “Glossary.”

Amesha Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans, stream terraces, and sedimentary plains
Parent Material: Alluvium
Slope range: 1 to 8 percent
Elevation range: 3,500 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Amesha silt loam, 1 to 3 percent slopes, in an area of cropland, 2,650 feet north and 2,630 feet west of the southeast corner of sec. 18, T. 10 N., R. 1 E.

Ap—0 to 7 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; weak coarse angular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—7 to 25 inches; white (10YR 8/2) silt loam, pale brown (10YR 6/3) moist; weak coarse prismatic parting to weak coarse angular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 2 percent pebbles; continuous faint lime casts on undersides of pebbles; disseminated lime and common faint lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—25 to 40 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; many very fine tubular and interstitial pores; 2 percent pebbles; disseminated lime and few fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C—40 to 60 inches; white (10YR 8/2) fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; 2 percent pebbles; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Bk horizon: 4 to 8 inches

Ap horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or silt loam
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Loam, sandy loam, or silt loam
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent cobbles; 0 to 5 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3

Texture: Loam or sandy loam
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent cobbles; 0 to 5 percent pebbles
Calcium carbonate equivalent: 15 to 35 percent
Reaction: pH 7.9 to 8.4

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Texture: Loam, sandy loam, or fine sandy loam
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 10 to 25 percent
Reaction: pH 7.9 to 8.4

136B—Amesha silt loam, 1 to 3 percent slopes

Setting

Landform: Alluvial fans
Slope: 1 to 3 percent
Elevation: 3,500 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Amesha and similar soils: 90 percent

Minor Components
Thess and similar soils: 0 to 5 percent
Sappington and similar soils: 0 to 5 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Aridic Ustifluvents

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Variable
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 120 days

Taxonomic Class: Aridic Ustifluvents

Typical Pedon

Aridic Ustifluvents, 0 to 4 percent slopes, in an area of rangeland, 195 feet south and 200 feet east of the northwest corner of sec. 36, T. 10 N., R. 2 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; neutral; clear smooth boundary.
C1—5 to 12 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky, nonplastic; common very fine roots; 25 percent pebbles; slightly alkaline; clear smooth boundary.
C2—12 to 18 inches; grayish brown (10YR 5/2) loam with thin strata of sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.
C3—18 to 25 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky, nonplastic; common very fine roots; common very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.
2C4—25 to 60 inches; grayish brown (10YR 5/2) extremely cobbly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, slightly sticky, nonplastic; common very fine roots to 30 inches and few below; 30 percent cobbles and 35 percent pebbles; slightly alkaline.

Range in Characteristics

A horizon
Texture: Loam, clay loam, or sandy loam
Content of rock fragments: 10 to 35 percent pebbles

C horizon to a depth of 20 inches:
Texture: Loam, clay loam, or sandy loam
Content of rock fragments: 15 to 35 percent pebbles

C horizon below a depth of 20 inches:
Texture: Loam, sandy loam, or loamy sand
Content of rock fragments: 0 to 70 percent pebbles

1B—Aridic Ustifluvents, 0 to 4 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 4 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Aridic Ustifluvents and similar soils: 90 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 4 percent
Soils with sand and gravel at 20 inches: 0 to 4 percent
Somewhat poorly drained soils: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Ashlo Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 30 inches and rapid below
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Aridic Calciustolls

Typical Pedon

Ashlo very cobbly loam, in an area of Binna-Ashlo complex, 0 to 2 percent slopes, in an area of rangeland, 1,300 feet north and 2,200 feet west of the southeast corner of sec. 21, T. 20 N., R. 6 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 20 percent cobbles and 20 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; many faint very dark grayish brown (10YR 3/2) moist organic coats peds; 20 percent cobbles and 15 percent pebbles; continuous faint lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—6 to 10 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 10 percent cobbles and 20 percent pebbles; continuous prominent lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—10 to 20 inches; white (10YR 8/2) extremely gravelly loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 10 percent cobbles and 60 percent pebbles; common rock- and cobble-size masses of petrocalcic material;

thick casts and pendants of cemented sand on undersides of cobbles and pebbles; many prominent lime coats on rock fragments; common fine soft masses of lime between fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—20 to 30 inches; very pale brown (10YR 8/3) extremely gravelly sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 10 percent cobbles and 65 percent pebbles; common rock- and cobble-size masses of petrocalcic material; continuous prominent casts and pendants of cemented sand on undersides of cobbles and pebbles; many prominent lime coats on rock fragments; common fine soft masses of lime between fragments; violently effervescent; moderately alkaline; clear smooth boundary.

2C—30 to 60 inches; pale brown (10YR 6/3) extremely gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; 10 percent cobbles and 65 percent pebbles; few cobble-size masses of petrocalcic material; continuous prominent lime casts and pendants of cemented sand and fine pebbles on undersides of larger rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the partially cemented Bk horizon: 10 to 20 inches
Depth to the sandy-skeletal 2C horizon: 20 to 40 inches

A1 horizon
Value: 4 or 5 dry
Chroma: 1 to 3
Clay content: 15 to 25 percent
Content of rock fragments: 35 to 60 percent—15 to 20 percent stones and cobbles; 20 to 40 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

A2 horizon
Value: 4 or 5 dry; 3 or 4 moist
Clay content: 15 to 25 percent
Content of rock fragments: 20 to 70 percent—10 to 30 percent stones and cobbles; 10 to 40 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 7 to 8 dry; 5 or 6 moist
Chroma: 2 to 4
Clay content: 10 to 18 percent
Content of rock fragments: 30 to 70 percent—10 to 15 percent stones and cobbles; 20 to 55 percent pebbles
Calcium carbonate equivalent: 15 to 35 percent
Reaction: pH 7.9 to 8.4

Bk2 and Bk3 horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 8 dry; 6 or 7 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 10 to 20 percent
Content of rock fragments: 60 to 80 percent (includes rock- and cobble-size petrocalcic material)—5 to 20 percent stones and cobbles; 50 to 65 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

2C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 60 to 80 percent (includes cobble-size petrocalcic material)—10 to 20 percent stones and cobbles; 50 to 65 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

Assinniboine Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and sedimentary plains
Parent material: Alluvium
Slope range: 2 to 8 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Assinniboine sandy loam, in an area of Assinniboine-Chinook sandy loams, 2 to 8 percent slopes, in an area of cropland, 1,500 feet south and 1,800 feet west of the northeast corner of sec. 36, T. 11 N., R. 4 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; neutral; abrupt smooth boundary.

Bt1—5 to 9 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct very dark grayish brown (10YR 3/2) moist, clay films on peds and bridging sand grains; neutral; clear smooth boundary.

Bt2—9 to 14 inches; pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct clay films on peds and bridging sand grains; slightly alkaline; gradual smooth boundary.

Bk1—14 to 36 inches; white (10YR 8/2) sandy loam, pale brown (10YR 6/3) moist; weak coarse angular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; many distinct lime coats on faces of peds; many medium irregular soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—36 to 50 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 10 percent pebbles; disseminated lime and common fine irregular soft masses of lime; many distinct lime coats on pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

BC—50 to 60 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 10 percent pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 43 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches; may include all or part of the Bt horizons
Depth to the Bk horizon: 10 to 25 inches

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Content of rock fragments: 0 to 25 percent pebbles
Clay content: 5 to 15 percent
Reaction: pH 6.1 to 7.8

Bt horizons
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Sandy clay loam or fine sandy loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 2.5Y or 10YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy loam, fine sandy loam, or sandy clay loam
Clay content: 10 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

BC horizon
Hue: 2.5Y or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam, sandy loam, loamy fine sand, fine sand, or stratifications of these textures
Clay content: 0 to 15 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

238B—Assinniboine-Chinook sandy loams, 2 to 8 percent slopes

Setting

Landform:
- Assinniboine—Alluvial fans
- Chinook—Alluvial fans

Slope:
- Assinniboine—2 to 8 percent
- Chinook—2 to 8 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Assinniboine and similar soils: 45 percent
Chinook and similar soils: 40 percent

Minor Components
Amesha and similar soils: 0 to 5 percent
Soils with very gravelly surface layers: 0 to 5 percent
Soils with sand and gravel at 30 inches: 0 to 5 percent

Major Component Description

Assinniboine
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Chinook
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Attewan Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 23 inches and rapid below
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 8 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy over sandy or sandy skeletal, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Attewan loam, 0 to 2 percent slopes, in an area of cropland, 50 feet north and 750 feet west of the southeast corner of sec. 18, T. 10 N., R. 2 W.

Ap—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky parting to weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; slightly acid; abrupt smooth boundary.

Bt—5 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular pores; many distinct clay films on faces of peds; 5 percent pebbles; neutral; gradual smooth boundary.

Bk1—10 to 18 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular pores; 12 percent pebbles; disseminated lime; continuous faint lime casts on undersides of rock fragments; violently effervescent; slightly alkaline; clear smooth boundary.

Bk2—18 to 23 inches; brownish yellow (10YR 6/6) very gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots in lower part and common very fine roots in upper part; 45 percent pebbles; continuous faint lime casts on undersides of pebbles; violently effervescent; slightly alkaline; clear smooth boundary.

2C—23 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky, nonplastic; 15 percent cobbles and 50 percent pebbles; continuous faint lime casts on undersides of coarse rock fragments in upper few inches; slightly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 12 inches; may include all or part of the argillic horizon
Depth to the Bk horizon: 10 to 21 inches
Depth to the 2C horizon: 20 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam, sandy clay loam, or loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 25 percent—0 to 5 percent greater than 3-inch stones and cobbles; 0 to 20 percent less than 3-inch pebbles
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4 or 6
Texture: Loam, clay loam, silt loam, sandy clay loam, or sandy loam
Clay content: 15 to 30 percent
Content of rock fragments: 0 to 30 percent—0 to 5 percent stones and cobbles; 0 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2C horizon
Hue: 2.5Y or 10YR
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loamy sand, sand, loamy coarse sand, or coarse sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 75 percent—0 to 15 percent stones and cobbles; 35 to 60 percent pebbles
Calcium carbonate equivalent: 2 to 10 percent
Reaction: pH 7.4 to 8.4

413A—Attewan loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Attewan and similar soils: 90 percent

Minor Components
Beaverell and similar soils: 0 to 4 percent
Nippt and similar soils: 0 to 3 percent
Thess and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

513A—Attewan-Nippt complex, 0 to 2 percent slopes

Setting

Landform:
- Attewan—Stream terraces
- Nippt—Stream terraces

Slope:
- Attewan—0 to 2 percent
- Nippt—0 to 2 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Attewan and similar soils: 60 percent
Nippt and similar soils: 30 percent

Minor Components
Nippt very cobbly loam surface: 0 to 5 percent
Nippt very gravelly loams: 0 to 5 percent

Major Component Description

Attewan
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Nippt
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Auchard Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Sedimentary plains
Parent material: Material derived from shale and mudstone
Slope range: 2 to 8 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, mixed, superactive, frigid Typic Natrustalfs

Typical Pedon

Auchard loam, in an area of Regent-Auchard loams, 2 to 8 percent slopes, in an area of rangeland, 100 feet north and 300 feet east of the southwest corner of sec. 36, T. 19 N., R. 5 W.

E—0 to 3 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate very thin platy structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; many light gray (10YR 7/2) silt and sand skeletans on faces of peds; neutral; abrupt smooth boundary.

Btn—3 to 9 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular pores; continuous distinct very dark grayish brown (10YR 3/2) moist clay films on faces of peds; silt and sand skeletans on tops of columns; moderately alkaline; clear smooth boundary.

Btkn—9 to 24 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; few fine seams and soft masses of lime; continuous faint lime coats on faces of peds; strongly effervescent; strongly alkaline; gradual smooth boundary.

By—24 to 33 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; common very fine tubular and interstitial pores; common fine seams and masses of gypsum; disseminated lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

Cr—33 to 60 inches; gray (5Y 6/1) semiconsolidated shale, gray (5Y 5/1) moist; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Btkn horizon: 5 to 15 inches
Depth to the Cr horizon: 20 to 40 inches

E horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent

Content of rock fragments: 0 to 10 percent pebbles
Reaction: pH 6.1 to 7.3

Btn horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 moist
Chroma: 2 or 3
Texture: Clay or silty clay
Clay content: 40 to 50 percent
Sodium adsorption ratio: 13 to 30
Reaction: pH 7.9 to 8.4

Btkn horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Electrical conductivity: 2 to 4 mmhos/cm
Sodium adsorption ratio: 13 to 30
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

By horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 30 to 45 percent
Electrical conductivity: 4 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Calcium carbonate equivalent: 5 to 15 percent
Gypsum content: 1 to 3 percent
Reaction: pH 7.9 to 9.0

Baxendale Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid to a depth of 22 inches and rapid below
Landform: Hills
Parent material: Material weathered from granitic rock
Slope range: 4 to 15 percent
Elevation range: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Baxendale sandy loam, in an area of Baxendale-Castner sandy loams, 4 to 15 percent slopes, in an area of rangeland, 1,800 feet north and 2,500 feet west of the southeast corner of sec. 33, T. 10 N., R. 5 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) sandy loam, very dark gray (10YR 3/1) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; slightly acid; clear smooth boundary.

A2—5 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic parting to moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; slightly acid; clear smooth boundary.

Bt1—9 to 14 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; common faint yellowish brown (10YR 5/6) clay films on faces of peds and clay bridging of sand grains; neutral; gradual wavy boundary.

Bt2—14 to 22 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; common reddish yellow (7.5YR 6/6) coats on faces of peds and clay bridging of sand grains; neutral; gradual wavy boundary.

C—22 to 60 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand, dark grayish brown (2.5Y 4/2) moist; massive; nonsticky nonplastic; few very fine roots in upper part; 15 percent angular pebbles; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 8 to 15 inches
Depth to the gravelly coarse sand C horizon: 20 to 30 inches

A horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 or 5 dry; 3 moist
Chroma: 1 or 2
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4 or 6
Clay content: 12 to 18 percent
Content of rock fragments: 0 to 15 percent angular pebbles
Reaction: pH 6.6 to 7.8

C horizon
Hue: 7.5YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Coarse sand or loamy coarse sand
Clay content: 0 to 5 percent
Content of rock fragments: 0 to 35 percent angular pebbles
Reaction: pH 6.1 to 7.8

761C—Baxendale-Castner complex, 4 to 15 percent slopes

Setting

Landform:
- Baxendale—Hills
- Castner—Hills

Position on landform:
- Baxendale—Backslopes and footslopes
- Castner—Backslopes and shoulders

Slope:
- Baxendale—4 to 15 percent
- Castner—4 to 15 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Baxendale and similar soils: 70 percent
Castner and similar soils: 20 percent

Minor Components
Soils that have slopes more than 15 percent: 0 to 5 percent
Areas of rock outcrop: 0 to 5 percent

Major Component Description

Baxendale
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.3 inches

Castner
Surface layer texture: Gravelly sandy loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Beanlake Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Alpine till
Slope range: 2 to 25 percent
Elevation range: 3,800 to 5,500 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Calciustolls

Typical Pedon

Beanlake stony loam, in an area of Beanlake-Winspect stony loams, 4 to 25 percent slopes, in an area of rangeland, 2,500 feet north and 2,200 feet east of the southwest corner of sec. 19, T. 20 N., R. 7 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent stones and 10 percent pebbles; slightly alkaline; clear smooth boundary.

Bk—6 to 16 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial

pores; 5 percent cobbles and 5 percent pebbles; disseminated lime; continuous faint lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bky1—16 to 38 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent cobbles; disseminated lime; continuous faint lime casts on undersides of rock fragments; common fine seams of gypsum; violently effervescent; moderately alkaline; gradual smooth boundary.

Bky2—38 to 60 inches; light gray (2.5Y 7/2) cobbly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; 20 percent cobbles and 15 percent pebbles; disseminated lime; continuous faint lime casts on undersides of rock fragments; common fine seams and masses of gypsum; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 8 inches

A horizon
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 30 percent—5 to 15 percent stones and cobbles; 10 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR
Value: 5 to 8 dry; 3 to 6 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Calcium carbonate equivalent: 15 to 25 percent
Content of rock fragments: 10 to 35 percent—0 to 20 percent stones and cobbles; 5 to 15 percent pebbles
Reaction: pH 7.9 to 8.4

Bky1 horizon
Hue: 10YR or 2.5Y
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Electrical conductivity: 2 to 4 mmhos/cm
Calcium carbonate equivalent: 15 to 25 percent
Gypsum content: 1 to 3 percent
Content of rock fragments: 10 to 35 percent—0 to 20 percent stones and cobbles; 5 to 15 percent pebbles
Reaction: pH 7.9 to 9.0

Bky2 horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Electrical conductivity: 2 to 4 mmhos/cm
Gypsum content: 1 to 3 percent
Calcium carbonate equivalent: 8 to 15 percent
Content of rock fragments: 15 to 40 percent—0 to 5 percent stones; 10 to 20 percent cobbles; 5 to 15 percent pebbles
Reaction: pH 7.9 to 9.0
Other features: Moist bulk density of more than 1.6 grams per cubic centimeter

343D—Beanlake-Winspect stony loams, dry, 2 to 25 percent slopes

Setting

Landform:
- Beanlake—Moraines
- Winspect—Moraines

Position on landform:
- Beanlake—Backslopes and footslopes
- Winspect—Backslopes and shoulders

Slope:
- Beanlake—2 to 25 percent
- Winspect—2 to 25 percent

Elevation: 3,800 to 4,300 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Beanlake and similar soils: 65 percent
Winspect and similar soils: 30 percent

Minor Components
Soils that are poorly drained and ponded: 0 to 2 percent
Delpoint and similar soils: 0 to 1 percent
Soils with loam surface layers: 0 to 1 percent
Soils that are deeper to lime: 0 to 1 percent

Major Component Description

Beanlake
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Winspect
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

543D—Beanlake-Winspect stony loams, 4 to 25 percent slopes

Setting

Landform:
- Beanlake—Moraines
- Winspect—Moraines

Position on landform:
- Beanlake—Backslopes and footslopes
- Winspect—Backslopes and shoulders

Slope:
- Beanlake—4 to 25 percent
- Winspect—4 to 25 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beanlake and similar soils: 65 percent
Winspect and similar soils: 30 percent

Minor Components
Fairfield and similar soils: 0 to 2 percent
Soils that are poorly drained and ponded: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Beanlake
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Winspect
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Beartooth Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium from limestone and argillite rock
Slope range: 25 to 60 percent
Elevation range: 4,600 to 5,200 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Beartooth loam, in an area of Beartooth-Whitecow, cool-Warneke cool complex, 25 to 60 percent slopes, in an area of forestland, 1,500 feet north and 20 feet

east of the southwest corner of sec. 15, T. 14 N., R. 2 W.

Oi—2 inches to 0; forest litter of slightly decomposed needles and twigs.

A—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; soft, friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; neutral; clear smooth boundary.

Bt—7 to 16 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic parting to moderate medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common distinct dark brown (10YR 3/2) moist, clay films on faces of peds; 10 percent angular pebbles; slightly alkaline; clear smooth boundary.

Bk1—16 to 37 inches; light gray (10YR 7/2) very gravelly loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium and coarse roots; many very fine tubular and interstitial pores; 10 percent angular cobbles and 35 percent angular pebbles; disseminated lime; continuous distinct lime casts on undersides of pebbles; many fine seams, threads and soft masses of lime; moderately alkaline; gradual smooth boundary.

Bk2—37 to 60 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few very fine, fine, and medium roots; common very fine tubular and interstitial pores; 10 percent angular cobbles and 35 percent angular pebbles; continuous distinct lime casts on undersides of pebbles; many fine seams, threads and soft masses of lime; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 45 degrees F
Depth to the Bk horizon: 12 to 30 inches

A horizon
Value: 4 or 5 dry; 2 or 3 moist
Clay content: 15 to 25 percent
Rock fragments: 0 to 10 percent—0 to 5 percent angular cobbles; 0 to 5 percent angular pebbles
Reaction: pH 6.6 to 7.8

Bt horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or silty clay loam
Clay content: 25 to 35 percent
Rock fragments: 10 to 35 percent—0 to 5 percent angular cobbles; 10 to 30 percent angular pebbles
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Rock fragments: 35 to 60 percent—5 to 15 percent angular cobbles; 30 to 45 percent angular pebbles
Calcium carbonate equivalent: 25 to 35 percent
Reaction: pH 7.9 to 8.4

884F—Beartooth-Whitecow, cool-Warneke, cool complex, 25 to 60 percent slopes

Setting

Landform:
- Beartooth—Mountains
- Whitecow—Mountains
- Warneke—Mountains

Position on landform:
- Beartooth—Backslopes and footslopes
- Whitecow—Backslopes and footslopes
- Warneke—Backslopes and shoulders

Slope:
- Beartooth—25 to 60 percent
- Whitecow—25 to 60 percent
- Warneke—25 to 60 percent

Elevation: 4,600 to 5,200 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beartooth and similar soils: 45 percent
Whitecow and similar soils: 35 percent
Warneke and similar soils: 15 percent

Minor Components

Soils with shale at 40 inches: 0 to 3 percent
Areas of rock outcrop: 0 to 2 percent

Major Component Description

Beartooth

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 6.7 inches

Whitecow

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Warneke

Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Beaverell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 19 inches and rapid below
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Beaverell very gravelly loam, 0 to 2 percent slopes, in an area of rangeland, 1,200 feet south and 1,000 feet east of the northwest corner of sec. 30, T. 20 N., R. 6 W.

A—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent cobbles and 25 percent pebbles; slightly alkaline; clear smooth boundary.

Bt—3 to 7 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; moderate very fine and fine subangular blocky structure; hard, friable, moderately sticky, moderately plastic; many very fine roots; many very fine tubular and interstitial pores; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 15 percent cobbles and 40 percent pebbles; neutral; clear smooth boundary.

Btk—7 to 11 inches; pale brown (10YR 6/3) extremely gravelly loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 5 percent cobbles and 60 percent pebbles; continuous distinct lime casts on undersides of rock fragments; common fine seams and soft masses of lime; strongly effervescent; slightly alkaline; gradual smooth boundary.

2Bk1—11 to 19 inches; light gray (10YR 7/2) extremely gravelly loamy sand, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; common very fine tubular and interstitial pores; 10 percent cobbles and 60 percent pebbles; continuous distinct lime casts on undersides of rock fragments; weak cementation of pebbles; sand grains on undersides of larger rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bk2—19 to 60 inches; pinkish gray (7.5YR 6/2) extremely gravelly sand, dark brown (7.5YR 4/2)

moist; single grain; nonsticky nonplastic; 20 percent cobbles and 50 percent pebbles; continuous distinct lime casts on undersides of rock fragments; weak cementation of pebbles; sand grains on undersides of larger rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches; may include all or part of the argillic horizon
Depth to the Bk horizon: 10 to 20 inches

A horizon
Value: 2 or 3 moist
Chroma: 2 or 3
Texture: Loam (very gravelly loam when mixed to 7 inches)
Clay content: 10 to 27 percent
Content of rock fragments: 15 to 60 percent—5 to 20 percent cobbles; 10 to 40 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 10YR or 7.5YR
Value: 3 to 5 dry; 2 to 4 moist
Chroma: 2 to 4
Texture: Clay loam, sandy clay loam, or loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles; 35 to 45 percent pebbles
Reaction: pH 6.6 to 7.8

Btk horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 3 to 6 dry; 2 to 4 moist
Chroma: 2 to 4 or 6
Texture: Clay loam, sandy clay loam, or loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles; 35 to 45 percent pebbles
Reaction: pH 6.6 to 7.8

2Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loamy sand, sand, or sandy loam
Clay content: 0 to 15 percent
Content of rock fragments: 35 to 75 percent—5 to 30 percent cobbles; 30 to 45 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2Bk2 horizon
Hue: 5YR, 10YR, or 2.5Y
Value: 4 to 6 dry; 4 to 6 moist
Chroma: 2 to 4 or 6
Texture: Loamy sand or sand
Clay content: 0 to 5 percent
Content of rock fragments: 35 to 80 percent—5 to 30 percent stones and cobbles; 30 to 60 percent pebbles
Calcium carbonate equivalent: 2 to 10 percent
Reaction: pH 7.4 to 8.4

465A—Beaverell-Ashlo very cobbly loams, 0 to 2 percent slopes

Setting

Landform:
- Beaverell—Stream terraces
- Ashlo—Stream terraces

Slope:
- Beaverell—0 to 2 percent
- Ashlo—0 to 2 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Beaverell and similar soils: 55 percent
Ashlo and similar soils: 30 percent

Minor Components
Rothiemay and similar soils: 0 to 10 percent
Soils with extremely cobbly loam surfaces: 0 to 5 percent

Major Component Description

Beaverell
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.2 inches

Ashlo
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

851A—Beaverell gravelly loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Beaverell and similar soils: 95 percent

Minor Components
Attewan and similar soils: 0 to 3 percent
Soils that are very shallow to loamy sand: 0 to 2 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

951A—Beaverell very gravelly loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Beaverell and similar soils: 95 percent

Minor Components
Attewan and similar soils: 0 to 3 percent
Soils that are very shallow to sand: 0 to 2 percent

Major Component Description

Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Beaverton Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 16 inches and rapid below
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 25 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal over sandy or sandy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Beaverton very cobbly loam, 0 to 4 percent slopes, in an area of rangeland, 700 feet north and 2,400 feet west of the southeast corner of sec. 34, T. 22 N., R. 8 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak thin platy parting to weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 25 percent cobbles and 25 percent pebbles; slightly alkaline; clear smooth boundary.

Bt—4 to 13 inches; dark brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; 15 percent cobbles and 45 percent pebbles; few faint lime coats on undersides of rock fragments in lower part of horizon; slightly alkaline; clear smooth boundary.

Btk—13 to 16 inches; brown (10YR 5/3) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; many very fine roots; few faint clay films on faces of peds; 20 percent cobbles and 50 percent pebbles; continuous distinct lime casts on undersides of rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

2Bk1—16 to 40 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; slightly sticky nonplastic; common very fine roots in upper part and few below; 15 percent cobbles and 65 percent pebbles; continuous distinct lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Bk2—40 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark brown (10YR 4/3) moist; single grain; few very fine roots; 20 percent cobbles and 50 percent pebbles; continuous distinct lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches; may include all or part of the Bt horizons
Depth to the Btk horizon: 10 to 20 inches

A horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 10 to 25 percent
Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 0 to 25 percent cobbles; 5 to 40 percent pebbles
Reaction: pH 6.6 to 7.8

Bt and Btk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 or 5 dry; 2 to 4 moist
Chroma: 2 or 3
Texture: Clay loam, sandy clay loam, or sandy loam
Clay content: 25 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 0 to 30 percent cobbles; 15 to 45 percent pebbles
Reaction: pH 6.6 to 7.8

2Bk1 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loamy sand or sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—0 to 10 percent stones; 0 to 35 percent cobbles; 15 to 60 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2Bk2 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 or 6 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loamy sand or sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—0 to 5 percent stones; 0 to 35 percent cobbles; 15 to 65 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

551B—Beaverton very cobbly loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beaverton and similar soils: 95 percent

Minor Components
Soils with extremely cobbly loam surfaces: 0 to 3 percent
Soils with gravelly loam surfaces: 0 to 2 percent

Major Component Description

Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

651B—Beaverton very stony sandy loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beaverton and similar soils: 95 percent

Minor Components
Soils with extremely stony surface layers: 0 to 3 percent
Soils with sandy loam surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Very stony sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

751B—Beaverton-Shawmut very gravelly loams, 1 to 4 percent slopes

Setting

Landform:
- Beaverton—Stream terraces
- Shawmut—Stream terraces

Slope:
- Beaverton—1 to 4 percent
- Shawmut—1 to 4 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beaverton and similar soils: 60 percent
Shawmut and similar soils: 30 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 5 percent
Soils with gravelly loam surface layers: 0 to 5 percent

Major Component Description

Beaverton
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

Shawmut
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Bignell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Mountains
Parent material: Alluvium, glacial till, or colluvium
Slope range: 8 to 60 percent
Elevation range: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 70 to 105 days

Taxonomic Class: Clayey-skeletal, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Bignell very stony loam, 8 to 35 percent slopes, in an area of forestland, 200 feet north and 1,850 feet west of the southeast corner of sec. 20, T. 11 N., R. 5 W.

A—0 to 3 inches; gray (10YR 5/1) very stony loam, very dark gray (10YR 3/1) moist; moderate very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; 5 percent stones and 25 percent cobbles; slightly acid; clear smooth boundary.

E/Bt—3 to 7 inches; 85 percent light brownish gray (10YR 6/2) cobbly loam, dark grayish brown (10YR 4/2) moist (E part); 15 percent brown (7.5YR 5/4) cobbly clay, dark brown (7.5YR 4/4) moist (B part); moderate very fine subangular blocky structure; soft, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent cobbles and 10 percent pebbles; moderately acid; clear smooth boundary.

Bt1—7 to 18 inches; brown (7.5YR 5/4) very cobbly clay, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine and fine tubular and interstitial pores; many distinct clay films on faces of peds; few decomposed tree roots; 15 percent cobbles and 20 percent pebbles; slightly acid; gradual smooth boundary.

Bt2—18 to 32 inches; brown (7.5YR 4/4) very cobbly clay, dark brown (7.5YR 5/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, moderately sticky, and very plastic; few very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; common dead roots between peds; 30 percent cobbles and 20 percent pebbles; slightly acid; gradual smooth boundary.

Bt3—32 to 45 inches; light yellowish brown (10YR 6/4) very cobbly clay loam, yellowish brown (10YR 5/4) moist; common medium distinct brownish yellow (10YR 6/6) mottles; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 30 percent cobbles and 20 percent pebbles; slightly acid; gradual smooth boundary.

Bt4—45 to 60 inches; light yellowish brown (10YR 6/4) very cobbly clay loam, yellowish brown (10YR 5/6) moist; common medium distinct brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; common distinct clay films on faces of peds; 30 percent angular cobbles and 25 percent pebbles; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 46 degrees F

E/Bt horizon
Hue: E part—7.5YR or 10YR; B part—7.5YR or 10YR
Value: E part—6 or 7 dry, 4 to 6 moist; B part—5 to 7 dry
Chroma: E part—2 or 3; B part—2, 4, or 6
Texture: Loam or sandy clay loam

Clay content: 15 to 25 percent
Content of rock fragments: 25 to 60 percent—0 to 25 percent cobbles; 15 to 55 percent pebbles
Reaction: pH 5.1 to 6.5

Bt horizons
Hue: 5YR, 7.5YR, or 10YR
Value: 5 to 7 dry; 3 to 6 moist
Chroma: 2 to 4 or 6
Texture: Clay, sandy clay, or clay loam
Clay content: 35 to 60 percent
Content of rock fragments: 35 to 60 percent—0 to 30 percent cobbles; 15 to 45 percent pebbles
Reaction: pH 5.1 to 6.5; below 40 inches the pH can range to 7.8

215E—Bignell very stony loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 70 to 105 days

Composition

Major Components
Bignell and similar soils: 85 percent

Minor Components
Soils that have slopes more than 35 percent: 0 to 5 percent
Colder soils on north aspects: 0 to 5 percent
Soils with cobbly loam surface layers: 0 to 5 percent

Major Component Description

Surface layer texture: Very stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Binna Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 28 inches and rapid below
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Calciustolls

Typical Pedon

Binna cobbly loam, in an area of Binna-Ashlo complex, 0 to 2 percent slopes, in an area of rangeland, 1,500 feet north and 2,500 feet west of the southeast corner of sec. 21, T. 20 N., R. 6 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 10 percent cobbles and 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.
Bk1—5 to 10 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous faint lime casts on undersides of rock fragments; disseminated lime and few fine irregular soft masses and seams of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
Bk2—10 to 25 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; weak medium and coarse prismatic parting to weak medium and coarse angular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous distinct lime casts on undersides of rock fragments; disseminated lime; common medium irregular soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk3—25 to 28 inches; very pale brown (10YR 7/3) extremely cobbly sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; 30 percent cobbles and 35 percent pebbles; continuous distinct lime coats on rock fragments; continuous prominent lime casts on undersides of rock fragments; lime-cemented fine sand and pebbles on undersides of cobbles; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk4—28 to 60 inches; pale brown (10YR 6/3) extremely cobbly loamy sand, dark brown (10YR 4/3) moist; single grain; loose; slightly sticky nonplastic; few very fine roots in upper part; 40 percent cobbles and 40 percent pebbles; continuous prominent lime casts on undersides of rock fragments; lime cemented fine sand and pebbles on undersides of cobbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the sandy-skeletal horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry (5 dry when mixed to 7 inches)
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent—5 to 10 percent cobbles; 5 to 25 percent pebbles
Reaction: pH 7.4 to 8.4

Bk1 and Bk2 horizons
Hue: 10YR or 2.5Y
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 30 percent—0 to 10 percent cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 9.0

Bk3 horizon
Hue: 10YR or 2.5Y
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 10 to 25 percent
Content of rock fragments: 0 to 30 percent—0 to 10 percent cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 10 to 30 percent
Reaction: pH 7.9 to 9.0

2Bk4 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—5 to 15 percent cobbles; 30 to 65 percent pebbles
Calcium carbonate equivalent: 10 to 20 percent
Reaction: pH 7.9 to 9.0

137A—Binna-Ashlo complex, 0 to 2 percent slopes

Setting

Landform:
- Binna—Stream terraces
- Ashlo—Stream terraces

Slope:
- Binna—0 to 2 percent
- Ashlo—0 to 2 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Binna and similar soils: 60 percent
Ashlo and similar soils: 30 percent

Minor Components
Rothiemay and similar soils: 0 to 6 percent
Soils with extremely cobbly loam surfaces: 0 to 4 percent

Major Component Description

Binna
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Ashlo
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Binvar Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Moderate to a depth of 24 inches and rapid below
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Binvar cobbly loam, 0 to 2 percent slopes, in an area of grassland, 30 feet south and 500 feet west of the northeast corner of sec. 23, T. 20 N., R. 6 W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) cobbly loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent cobbles and 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—6 to 12 inches; brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; 10 percent pebbles; continuous distinct lime casts on undersides of pebbles; disseminated lime; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—12 to 20 inches; pale brown (10YR 6/3) loam, white (10YR 8/2) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; 10 percent pebbles; disseminated lime; many fine soft masses of lime; continuous distinct lime coats on pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—20 to 24 inches; very pale brown (10YR 7/3) very gravelly loam, white (10YR 8/2) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; 10 percent cobbles and 40 percent pebbles; disseminated lime; many fine soft masses of lime; continuous distinct lime coats on cobbles and pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk4—24 to 36 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, white (10YR 8/2) dry; massive; soft, very friable, slightly sticky, nonplastic; 20 percent cobbles and 45 percent pebbles; disseminated lime; many fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

2C—36 to 60 inches; dark brown (10YR 4/3) extremely gravelly loamy sand, pale brown (10YR 6/3) dry; single grain; loose, nonsticky, nonplastic; 15 percent cobbles and 50 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the 2C horizon: 20 to 40 inches
Depth to the seasonal high water table: 12 to 24 inches

A horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Clay content: 18 to 25 percent
Content of rock fragments: 15 to 35 percent—10 to 20 percent cobbles; 5 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 and Bk2 horizons
Hue: 10YR or 2.5YR
Value: 4 to 6 moist; 5 to 8 dry
Chroma: 2 to 4
Clay content: 18 to 25 percent
Content of rock fragments: 5 to 15 percent—0 to 5 percent cobbles; 5 to 10 percent pebbles
Calcium carbonate equivalent: 20 to 30 percent
Reaction: pH 7.9 to 8.4

Bk3 and Bk4 horizons
Hue: 10YR or 2.5YR
Value: 5 to 7 moist; 7 or 8 dry
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 10 to 15 percent
Content of rock fragments: 50 to 75 percent—10 to 20 percent cobbles; 40 to 55 percent pebbles
Calcium carbonate equivalent: 20 to 30 percent
Reaction: pH 7.9 to 8.4

2C horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 3 or 4
Texture: Loamy sand or sand
Clay content: 0 to 5 percent
Content of rock fragments: 60 to 80 percent—10 to 20 percent cobbles; 50 to 60 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

122A—Binvar cobbly loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Binvar and similar soils: 90 percent

Minor Components
Soils with more rock fragments: 0 to 4 percent
Somewhat poorly drained soils: 0 to 2 percent
Soils with loam surface layers: 0 to 2 percent
Soils with clay loam surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 12 to 24 inches
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Blaincreek Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills
Parent material: Residuum derived from igneous bedrock
Slope range: 4 to 35 percent
Elevation range: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Blaincreek gravelly loam, in an area of Blaincreek-Castner gravelly loams, 4 to 25 percent slopes, in an area of rangeland, 1,800 feet south and 1,700 feet west of the northeast corner of sec. 16, T. 15 N., R. 4 W.

A—0 to 4 inches; brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak very thin platy parting to weak very fine granular structure; soft, very friable, moderately sticky, slightly plastic; many very fine roots; 25 percent angular and rounded pebbles; neutral; clear smooth boundary.

Bt1—4 to 12 inches; dark brown (7.5YR 4/2) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; 30 percent angular and rounded pebbles; neutral; gradual smooth boundary.

Bt2—12 to 24 inches; brown (7.5YR 5/2) very gravelly loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct dark brown

(7.5YR 3/4) clay films on faces of peds; 50 percent angular and rounded pebbles; neutral; gradual smooth boundary.

R—24 inches; hard igneous bedrock; few cracks; few very fine roots in some cracks; continuous faint lime coats in cracks.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to bedrock: 20 to 40 inches

A horizon
Hue: 10YR or 7.5YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent angular and rounded pebbles
Reaction: pH 6.1 to 7.3

Bt1 horizon
Hue: 10YR or 7.5YR
Value: 4 or 5 dry
Chroma: 2 or 3
Clay content: 27 to 35 percent
Content of rock fragments: 30 to 60 percent—0 to 10 percent angular cobbles; 30 to 50 percent angular and rounded pebbles
Reaction: pH 6.6 to 7.8

Bt2 horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—5 to 10 percent angular cobbles; 30 to 50 percent angular and rounded pebbles
Reaction: pH 6.6 to 7.8

260D—Blaincreek-Castner gravelly loams, 4 to 25 percent slopes

Setting

Landform:
• Blaincreek—Hills
• Castner—Hills
Position on landform:
• Blaincreek—Backslopes
• Castner—Backslopes and shoulders
Slope:
• Blaincreek—4 to 25 percent
• Castner—4 to 25 percent
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Blaincreek and similar soils: 50 percent
Castner and similar soils: 40 percent

Minor Components
Areas of rock outcrop: 0 to 4 percent
Very shallow soils: 0 to 4 percent
Soils with less rock fragments: 0 to 2 percent

Major Component Description

Blaincreek
Surface layer texture: Gravelly loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Castner
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Bridger Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained or moderately well drained
Permeability: Moderately slow
Landform: Mountains
Parent material: Alluvium, glacial till, or colluvium
Slope range: 4 to 35 percent
Elevation range: 4,800 to 6,500 feet

Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Fine, mixed, superactive Ustic Argicryolls

Typical Pedon

Bridger loam, 4 to 25 percent slopes, in an area of rangeland, 600 feet north and 1,700 feet west of the southeast corner of sec. 21, T. 19 N., R. 8 W.

A—0 to 8 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent pebbles; slightly acid; clear smooth boundary.

Bt1—8 to 14 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; strong fine and medium prismatic parting to strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 5 percent pebbles; slightly acid; clear smooth boundary.

Bt2—14 to 27 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; strong medium prismatic structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many prominent clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—27 to 40 inches; brown (7.5YR 5/4) cobbly clay loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 15 percent cobbles and 15 percent pebbles; slightly acid; gradual smooth boundary.

Bk—40 to 60 inches; pinkish gray (7.5YR 6/2) very cobbly loam, dark brown (7.5YR 4/2) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; 25 percent cobbles and 25 percent pebbles; continuous faint lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 38 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Bk horizon: 17 to 40 inches

A horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 2 to 4
Chroma: 1 or 2
Clay content: 18 to 27 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent stones and cobbles; 5 to 25 percent pebbles
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry
Chroma: 2 to 4
Texture: Clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent stones and cobbles; 5 to 25 percent pebbles
Reaction: pH 6.1 to 7.8

Bk horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Clay loam, sandy clay loam, or loam
Clay content: 20 to 35 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent stones and cobbles; 5 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

73D—Bridger loam, 4 to 25 percent slopes

Setting

Landform: Mountains
Slope: 4 to 25 percent
Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Bridger and similar soils: 85 percent

Minor Components
Leavitt and similar soils: 0 to 5 percent
Soils with stony loam surface layers: 0 to 5 percent
Soils that have slopes more than 25 percent: 0 to 5 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

700D—Bridger silt loam, moderately wet, 4 to 25 percent slopes

Setting

Landform: Mountains
Slope: 4 to 25 percent
Elevation: 4,800 to 5,500 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Bridger and similar soils: 90 percent

Minor Components
Somewhat poorly drained soils: 0 to 4 percent
Poorly drained soils: 0 to 4 percent
Soils with less clay content: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Depth to the seasonal high water table: Apparent, 48 to 60 inches
Available water capacity: Mainly 9.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Brocko Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Sedimentary plains and hills
Parent material: Loess or lacustrine deposits
Slope range: 2 to 35 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-silty, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Brocko silt loam, 2 to 8 percent slopes, in an area of cropland, 1,900 feet south and 2,800 feet east of the northwest corner of sec. 18, T. 10 N., R. 1 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; slightly alkaline; abrupt smooth boundary.

Bk1—5 to 30 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; continuous faint lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—30 to 55 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular pores; disseminated lime; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C—55 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; 10 percent pebbles; continuous faint lime coats on undersides of pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the calcic horizon: 5 to 8 inches

Ap horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 10 to 18 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 7 or 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Silt loam, very fine sandy loam, or loam
Clay content: 10 to 18 percent with less than 15 percent fine sand and coarser
Calcium carbonate equivalent: 15 to 35 percent
Reaction: pH 7.9 to 8.4

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Silt loam, loam, or very fine sandy loam
Clay content: 10 to 18 percent with less than 15 percent fine and coarser sand
Calcium carbonate equivalent: 5 to 25 percent
Gypsum content: 1 to 3 percent
Reaction: pH 7.9 to 8.4

26C—Brocko silt loam, 2 to 8 percent slopes

Setting

Landform: Sedimentary plains
Slope: 2 to 8 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Brocko and similar soils: 95 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 2 percent
Silty clay loam soils: 0 to 2 percent
Soils with noncalcareous surface layers: 0 to 1 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Lacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 11.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

26D—Brocko silt loam, 8 to 15 percent slopes

Setting

Landform: Hills
Slope: 8 to 15 percent
Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Brocko and similar soils: 90 percent

Minor Components
Soils that have slopes more than 15 percent: 0 to 5 percent
Silty clay loam soils: 0 to 5 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Lacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 11.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

139D—Brocko-Chinook complex, 8 to 35 percent slopes

Setting

Landform:
- Brocko—Hills
- Chinook—Hills

Slope:
- Brocko—8 to 35 percent
- Chinook—8 to 35 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Brocko and similar soils: 50 percent
Chinook and similar soils: 40 percent

Minor Components
Lihen and similar soils: 0 to 4 percent
Soils that have slopes more than 35 percent: 0 to 3 percent
Soils that have hard bedrock at shallow depths: 0 to 3 percent

Major Component Description

Brocko
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Lacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 11.9 inches

Chinook
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Burgraff Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Sedimentary plains
Parent material: Material weathered from semiconsolidated, sedimentary bedrock
Slope range: 2 to 8 percent
Elevation range: 3,800 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-silty, mixed, superactive, frigid Aridic Calciustolls

Typical Pedon

Burgraff silt loam, in an area of Burgraff-Cabbart complex, 2 to 8 percent slopes, in an area of rangeland, 2,500 feet south and 2,400 feet east of the northwest corner of sec. 34, T. 20 N., R. 6 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; strongly effervescent; slightly alkaline; clear smooth boundary.

A2—3 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—6 to 17 inches; pinkish gray (7.5YR 7/2) silt loam, pinkish gray (7.5YR 6/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent angular pebbles of siltstone; many fine and medium seams of lime; continuous faint lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—17 to 27 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent angular pebbles of siltstone; common fine and medium seams of lime; continuous faint lime coats on faces of peds;

violently effervescent; moderately alkaline; gradual smooth boundary.
Cr—27 to 60 inches; gray (5Y 6/1) fractured semiconsolidated siltstone; few fine roots in fractures in upper part; strongly effervescent.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 20 to 40 inches

A horizons
Hue: 7.5YR or 10YR
Chroma: 2 or 3
Clay content: 20 to 25 percent
Content of rock fragments: 0 to 15 percent soft channers
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Silt loam or silty clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 25 percent soft channers
Calcium carbonate equivalent: 25 to 35 percent
Reaction: pH 7.9 to 8.4

582C—Burgraff-Cabbart complex, 2 to 8 percent slopes

Setting

Landform:
• Burgraff—Sedimentary plains
• Cabbart—Sedimentary plains
Position on landform:
• Burgraff—Backslopes
• Cabbart—Backslopes and shoulders
Slope:
• Burgraff—2 to 8 percent
• Cabbart—2 to 8 percent
Elevation: 3,800 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Burgraff and similar soils: 65 percent
Cabbart and similar soils: 25 percent

Minor Components
Rothiemay and similar soils: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 3 percent
Shallow clay loam soils: 0 to 2 percent
Shallow clay textured soils: 0 to 2 percent

Major Component Description

Burgraff
Surface layer texture: Silt loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.0 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Cabba Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Sedimentary plains and hills
Parent material: Material derived from sandstone
Slope range: 2 to 60 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy, mixed, superactive, calcareous, frigid, shallow Typic Ustorthents

Typical Pedon

Cabba loam, in an area of Wayden-Cabba-Regent complex, 15 to 45 percent slopes, in an area of rangeland, 800 feet north and 2,200 feet west of the southeast corner of sec. 3, T. 18 N., R. 5 W.

A—0 to 4 inches grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—4 to 10 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 35 percent angular soft sandstone fragments; disseminated lime; continuous faint lime coats on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—10 to 18 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine roots; common very fine tubular and interstitial pores; 60 percent angular soft sandstone fragments; disseminated lime; continuous faint lime coats on rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Cr—18 to 60 inches; light olive gray (5Y 6/2) semiconsolidated sandstone, olive (5Y 4/3) moist; roots matted at upper boundary; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 6 dry; 3 or 4 moist
Chroma: 1 to 4
Clay content: 10 to 27 percent
Electrical conductivity: 0 to 4 mmhos/cm
Effervescence: None to violently
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 9.0

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 1 to 4 or 6
Texture: Loam, silt loam, clay loam, or silty clay loam
Clay content: 20 to 35 percent
Structure: Massive thin platy, subangular blocky, or prismatic
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 8 mmhos/cm
Reaction: pH 7.4 to 9.0

Cr horizon
Reaction: pH 7.4 to 8.4

Cabbart Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Material derived from semiconsolidated sedimentary bedrock
Slope range: 2 to 60 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy, mixed, superactive, calcareous, frigid, shallow Aridic Ustorthents

Typical Pedon

Cabbart loam, in an area of Delpoint-Cabbart loams, 8 to 35 percent slopes, in an area of rangeland, 1,200 feet north and 900 feet west of the southeast corner of sec. 13, T. 20 N., R. 7 W.

A—0 to 4 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak very thin platy parting to weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent angular pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—4 to 10 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 5 percent angular pebbles; disseminated lime; continuous faint lime coats on undersides of pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—10 to 14 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; slightly hard, very

friable, slightly sticky, slightly plastic; many very fine and fine roots; 70 percent soft shale fragments; continuous faint lime coats on undersides of pebbles; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cr—14 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated sedimentary beds, olive gray (5Y 5/2) moist; few fine roots in upper 6 inches; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent hard fragments—0 to 5 percent cobbles; 0 to 10 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 9.0

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, silt loam, or silty clay loam
Clay content: 18 to 35 percent
Structure: Massive, prismatic, or blocky
Content of rock fragments: 0 to 45 percent—0 to 15 percent hard pebbles, 0 to 45 percent soft pebbles
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 1 to 5
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.4 to 9.0

Cadotte Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 32 inches and rapid below
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,500 to 5,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Haplocryalfs

Typical Pedon

Cadotte gravelly loam, 0 to 4 percent slopes, in an area of forestland, 2,450 feet north and 2,500 feet east of the southwest corner of sec. 24, T. 15 N., R. 8 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter of needles and twigs.

A—0 to 3 inches; dark gray (10YR 4/1) gravelly loam, very dark gray (10YR 3/1) moist; weak very thin platy parting to weak very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; 20 percent pebbles; moderately acid; abrupt smooth boundary.

Bt/A—3 to 8 inches; 80 percent brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist (B part); 20 percent grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist (A part); moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and few medium roots; many very fine tubular and interstitial pores; few distinct clay films on faces of peds; 30 percent pebbles; moderately acid; clear smooth boundary.

Bt1—8 to 18 inches; yellowish brown (10YR 5/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and few medium roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 10 percent cobbles and 40 percent pebbles; moderately acid; clear smooth boundary.

Bt2—18 to 23 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds; 10 percent cobbles and 45 percent pebbles; moderately acid; gradual smooth boundary.

Bt3—23 to 32 inches; brown (10YR 5/3) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; clay bridging sand grains;

20 percent cobbles and 45 percent pebbles; neutral; gradual smooth boundary.

2Bk—32 to 60 inches; brown (10YR 5/3) extremely gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose, slightly sticky, nonplastic; few very fine roots; 20 percent cobbles and 45 percent pebbles; strongly effervescent; continuous faint lime casts on undersides of rock fragments; slightly alkaline.

Range in Characteristics

Soil temperature: 38 to 44 degrees F
Depth to the 2Bk horizon: 20 to 40 inches
Other features: When mixed to a depth of 7 inches, the dark-colored A horizon will not meet the requirements for a mollic epipedon

A horizon
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 1 to 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent pebbles
Reaction: pH 5.6 to 6.0

Bt/A horizon
Value: B part—5 or 6 dry; 3 or 4 moist; A part—5 or 6 dry; 3 or 4 moist
Chroma: B part—3 or 4; A part—2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent pebbles
Reaction: pH 5.6 to 6.0

Bt1 and Bt2 horizons
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 3 or 4
Texture: Loam, sandy loam, or clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 45 to 65 percent—5 to 15 percent cobbles; 40 to 50 percent pebbles
Reaction: pH 5.6 to 6.0

Bt3 horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 4 moist
Chroma: 2 or 3
Clay content: 5 to 20 percent
Content of rock fragments: 50 to 70 percent—10 to 20 percent cobbles; 40 to 50 percent pebbles
Reaction: pH 5.6 to 7.3

2Bk horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sand or loamy sand
Clay content: 0 to 5 percent
Content of rock fragments: 60 to 75 percent—10 to 20 percent cobbles; 40 to 65 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

91B—Cadotte gravelly loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Cadotte and similar soils: 95 percent

Minor Components
Somewhat poorly drained soils: 0 to 2 percent
Soils that are shallow to sand and gravel: 0 to 2 percent
Soils with darker colored surface layers: 0 to 1 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Castner Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountains
Parent material: Material derived from argillite, igneous, and sandstone bedrock
Slope range: 4 to 60 percent
Elevation range: 3,500 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Haplustolls

Typical Pedon

Castner channery loam, in an area of Holter-Castner channery loams, 8 to 45 percent slopes, in an area of rangeland, 1,000 feet south and 900 feet east of the northwest corner of sec. 28, T. 13 N., R. 4 W.

A1—0 to 3 inches; brown (10YR 5/3) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 30 percent channers; neutral; clear smooth boundary.

A2—3 to 8 inches; grayish brown (10YR 5/2) very channery loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic parting to moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 45 percent channers; neutral; clear smooth boundary.

Bk—8 to 16 inches; yellowish brown (10YR 5/4) very channery loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 60 percent channers; few thin lime coats on undersides of rock fragments; neutral; abrupt smooth boundary.

R—16 inches; fractured argillite bedrock with few cracks; few fine roots in some cracks.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to bedrock: 10 to 20 inches
Depth to the Bk horizon: 7 to 15 inches
Soil phases: Stony

A1 horizon
Hue: 2.5Y, 10YR, 7.5YR, or 5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Texture: Loam or sandy loam
Clay content: 5 to 18 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 15 to 35 percent—0 to 5 percent stones and cobbles; 15 to 30 percent pebbles or channers
Reaction: pH 6.6 to 7.8

A2 horizon
Hue: 2.5Y, 10YR, 7.5YR, or 5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Texture: Loam or sandy loam
Clay content: 10 to 18 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 35 to 70 percent—5 to 20 percent stones and cobbles; 30 to 55 percent pebbles or channers
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 2.5Y, 10YR, 7.5YR, or 5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 10 to 18 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 35 to 80 percent—10 to 25 percent stones and cobbles; 25 to 60 percent pebbles or channers
Calcium carbonate equivalent: 3 to 15 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 6.6 to 8.4

160D—Castner-Blaincreek-Rock outcrop complex, 4 to 35 percent slopes

Setting

Landform:
- Castner—Hills
- Blaincreek—Hills

Position on landform:
- Castner—Backslopes and shoulders
- Blaincreek—Backslopes and footslopes
- Rock outcrop—Shoulders

Slope:
- Castner—4 to 35 percent
- Blaincreek—4 to 35 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Castner and similar soils: 55 percent
Blaincreek and similar soils: 30 percent
Rock outcrop: 10 percent

Minor Components
Farnuf and similar soils: 0 to 3 percent
Soils that have slopes more than 35 percent: 0 to 2 percent

Major Component Description

Castner
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Blaincreek
Surface layer texture: Gravelly loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Rock outcrop
Definition: Hard igneous bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

360F—Castner-Holter-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform:
- Castner—Hills
- Holter—Hills

Position on landform:
- Castner—Backslopes and shoulders
- Holter—Backslopes and footslopes
- Rock outcrop—Shoulders

Slope:
- Castner—15 to 60 percent
- Holter—15 to 45 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Castner and similar soils: 45 percent
Holter and similar soils: 35 percent
Rock outcrop: 15 percent

Minor Components
Mocmont soils on north aspects: 0 to 3 percent
Mocmont soils on east aspects: 0 to 2 percent

Major Component Description

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Holter
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Rock outcrop
Definition: Hard igneous and argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

863E—Castner-Tolex-Rock outcrop complex, 8 to 60 percent slopes

Setting

Landform:
- Castner—Mountains
- Tolex—Mountains

Slope:
- Castner—8 to 60 percent
- Tolex—8 to 60 percent

Elevation: 3,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Castner and similar soils: 40 percent
Tolex and similar soils: 35 percent
Rock outcrop: 20 percent

Minor Components
Very deep loam textured soils: 0 to 5 percent

Major Component Description

Castner
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Tolex
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

Rock outcrop
Definition: Hard igneous and argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Cheadle Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Material derived from hard sedimentary rock, hard argillite, or igneous rock
Slope range: 15 to 60 percent
Elevation range: 4,800 to 7,800 feet
Mean annual precipitation: 20 to 35 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryolls

Typical Pedon

Cheadle very channery loam, in an area of Libeg-Cheadle very channery loams, 15 to 45 percent slopes, in an area of rangeland, 2,600 feet north and 2,200 feet west of the southeast corner of sec. 17, T. 11 N., R. 5 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) very channery loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 55 percent channers; neutral; clear smooth boundary.

Bw—7 to 14 inches; brown (10YR 5/3) very channery loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 60 percent channers; slightly alkaline; abrupt wavy boundary.

R—14 inches; hard argillite bedrock with few cracks; few fine roots in some cracks.

Range in Characteristics

Soil temperature: 37 to 47 degrees F; mean summer is less than 59 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to bedrock: 10 to 20 inches
Soil phases: Nonstony

A horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 10 to 27 percent
Content of rock fragments: 35 to 60 percent channers
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 3 or 4
Texture: Loam, fine sandy loam, or sandy loam
Clay content: 10 to 27 percent
Content of rock fragments: 35 to 75 percent channers
Reaction: pH 7.4 to 9.0

Chinook Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Alluvial fans and hills
Parent material: Alluvium
Slope range: 2 to 35 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Aridic Haplustolls

Typical Pedon

Chinook sandy loam, in an area of Assinniboine-Chinook sandy loams, 2 to 8 percent slopes, in an area of rangeland, 300 feet north and 2,500 feet west of the southeast corner of sec. 25, T. 11 N., R. 4 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; slightly alkaline; clear smooth boundary.

A2—5 to 8 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.

Bw—8 to 16 inches; light grayish brown (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/3) moist; weak medium prismatic structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few brown to dark brown (10YR 4/3) moist, faint clay films on peds and bridging of sand grains; few thin white lime coats on faces of peds and undersides of pebbles; 10 percent pebbles; neutral; gradual smooth boundary.

Bk1—16 to 38 inches; light gray (2.5Y 7/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 10 percent pebbles; disseminated lime; many distinct lime coats on faces of peds and undersides of pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—38 to 50 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 10 percent pebbles; disseminated lime; many distinct lime coats on faces of peds and undersides of pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—50 to 60 inches; light gray (2.5Y 7/2) loamy sand, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 10 percent pebbles; disseminated lime; few faint lime coats on faces of peds and pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bk horizon: 10 to 35 inches

A1 horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 2 or 3
Clay content: 5 to 18 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

A2 horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 to 4 moist
Chroma: 2 to 4
Textures: Fine sandy loam or sandy loam
Clay content: 5 to 18 percent—more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Textures: Fine sandy loam or sandy loam
Clay content: 5 to 18 percent—more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

Bk1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Textures: Fine sandy loam or sandy loam
Clay content: 5 to 18 percent—more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 3 to 15 percent
Reaction: pH 6.6 to 9.0

Bk2 and Bk3 horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loamy sand, fine sandy loam, or sandy loam
Clay content: 5 to 18 percent—more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 3 to 15 percent
Reaction: pH 6.6 to 9.0

39B—Chinook sandy loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Chinook and similar soils: 90 percent

Minor Components
Amesha and similar soils: 0 to 3 percent
Assinniboine and similar soils: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 2 percent
Soils with sand and gravel at 30 inches: 0 to 1 percent
Soils with silt loam layers: 0 to 1 percent

Major Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Comad Series

Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Permeability: Rapid
Landform: Mountains
Parent material: Colluvium derived from granitic rock
Slope range: 25 to 45 percent
Elevation range: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Sandy-skeletal, mixed Lamellic Cryorthents

Typical Pedon

Comad extremely stony sandy loam, 25 to 45 percent slopes, in an area of forestland, 2,200 feet south and 1,200 feet west of the northeast corner of sec. 35, T. 12 N., R. 6 W.

Oi—4 inches to 0; forest litter of partly decomposed needles, twigs, and bark; clear smooth boundary.
E1—0 to 5 inches; light brownish gray (10YR 6/2) extremely stony sandy loam, brown (10YR 5/3) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium and coarse roots; 30 percent stones, 25 percent cobbles, and 15 percent pebbles; strongly acid; clear smooth boundary.

E2—5 to 17 inches; pale brown (10YR 7/3) extremely stony loamy sand, brown (10YR 5/3) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 30 percent stones, 25 percent cobbles, and 15 percent pebbles; strongly acid; gradual wavy boundary.

E and Bt1—17 to 30 inches; 90 percent very pale brown (10YR 7/3) extremely stony loamy sand, yellowish brown (10YR 5/4) moist, weak fine and medium granular structure, slightly hard, very friable, nonsticky, nonplastic (E part); 10 percent yellowish brown (10YR 5/4) sandy clay loam lamellae; hard, friable, slightly sticky, slightly plastic; $^{1}/_{8}$- to $^{1}/_{2}$-inch thick lamellae that are wavy and discontinuous and 2 to 6 inches apart (B part); common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 30 percent stones, 25 percent cobbles, and 20 percent pebbles; moderately acid; gradual smooth boundary.

E and Bt2—30 to 60 inches; 95 percent very pale brown (10YR 7/4) extremely stony loamy sand, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; few fine and medium roots; few very fine tubular pores (E part); 5 percent few thin discontinuous dark yellowish brown (10YR 4/4) moist sandy loam lamellae; 35 percent stones, 30 percent cobbles, and 15 percent pebbles; moderately acid (B part).

Range in Characteristics

Soil temperature: 36 to 43 degrees F
Depth to lamellae: 13 to 20 inches

E1 horizon
Hue: 7.5YR or 10YR
Value: 6 or 7 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 5 to 15 percent
Content of rock fragments: 60 to 85 percent—15 to 35 percent stones; 20 to 30 percent cobbles; 10 to 15 percent pebbles
Reaction: pH 5.1 to 7.3

E2 horizon
Hue: 7.5YR or 10YR
Value: 6 to 8 dry; 3 to 6 moist
Chroma: 2 or 3
Clay content: 5 to 15 percent
Content of rock fragments: 35 to 80 percent—10 to 35 percent boulders and stones; 15 to 25 percent cobbles; 10 to 20 percent pebbles
Reaction: pH 5.1 to 7.3

E and Bt1 horizon
Hue: 7.5YR or 10YR
Value: E part—6 or 7 dry; 4 to 6 moist; B part—5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4 or 6
Texture: Sand, coarse sand, or loamy sand; the lamellae are sandy loam or sandy clay loam.
Clay content: 0 to 10 percent
Content of rock fragments: 40 to 80 percent—15 to 35 percent stones; 15 to 25 percent cobbles; 10 to 20 percent pebbles
Reaction: pH 5.6 to 7.3

E and Bt2 horizon
Hue: 7.5YR or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4, or 6
Texture: Sand, coarse sand or loamy sand; the lamellae are sandy loam or sandy clay loam.
Clay content: 0 to 10 percent
Content of rock fragments: 45 to 80 percent—20 to 35 percent boulders and stones; 15 to 30 percent cobbles; 10 to 20 percent pebbles
Reaction: pH 5.6 to 7.3

86F—Comad extremely stony sandy loam, 25 to 45 percent slopes

Setting

Landform: Mountains
Slope: 25 to 45 percent
Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Comad and similar soils: 85 percent

Minor Components
Soils that have slopes more than 45 percent: 0 to 5 percent
Areas of rock outcrop: 0 to 5 percent
Very deep loam soils: 0 to 5 percent

Major Component Description

Surface layer texture: Extremely stony sandy loam
Depth class: Very deep (more than 60 inches)

Drainage class: Excessively drained
Dominant parent material: Granitic colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Cowood Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Material derived from igneous and argillite bedrock
Slope range: 25 to 60 percent
Elevation range: 5,000 to 7,800 feet
Mean annual precipitation: 20 to 35 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Eutrocryepts

Typical Pedon

Cowood very channery loam, in an area of Shadow-Cowood complex, 25 to 60 percent slopes, in an area of forestland, 2,650 feet north and 1,700 feet east of the southwest corner of sec. 29, T. 14 N., R. 5 W.

Oi—1 inch to 0; root mat and forest litter of needles and twigs; abrupt smooth boundary.

E—0 to 4 inches; brown (10YR 5/3) very channery loam, dark brown (10YR 4/3) moist; moderate very thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many very fine tubular and interstitial pores; many silt and sand skeletans on faces of peds; 40 percent channers; strongly acid; clear smooth boundary.

Bw—4 to 15 inches; light yellowish brown (10YR 6/4) extremely channery loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky parting to moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine tubular and interstitial pores; 65 percent channers; strongly acid; abrupt wavy boundary.

R—15 inches; hard argillite bedrock with few vertical cracks; few fine roots in some cracks.

Range in Characteristics

Soil temperature: 35 to 40 degrees F
Depth to bedrock: 10 to 20 inches

E horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 50 percent channers
Reaction: pH 5.1 to 6.0

Bw horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 3, 4, or 6
Clay content: 10 to 20 percent
Content of rock fragments: 60 to 80 percent channers
Reaction: pH 5.1 to 6.5

793F—Cowood-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform: Mountains
Slope: 25 to 60 percent
Elevation: 6,500 to 7,800 feet
Mean annual precipitation: 25 to 35 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Cowood and similar soils: 70 percent
Rock outcrop: 25 percent

Minor Components
Cheadle and similar soils: 0 to 2 percent
Stemple and similar soils: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Cowood
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland

Flooding: None
Available water capacity: Mainly 1.0 inches

Rock outcrop
Definition: Hard argillite and igneous bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

893F—Cowood-Cheadle-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform:
- Cowood—Mountains
- Cheadle—Mountains

Slope:
- Cowood—25 to 60 percent
- Cheadle—25 to 60 percent

Elevation: 6,000 to 7,800 feet
Mean annual precipitation: 25 to 35 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Cowood and similar soils: 45 percent
Cheadle and similar soils: 30 percent
Rock outcrop: 15 percent

Minor Components
Stemple and similar soils: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Cowood
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

Cheadle
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

Rock outcrop
Definition: Hard argillite and igneous bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Crago Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills, mountains, alluvial fans, and stream terraces
Parent material: Alluvium and colluvium from limestone
Slope range: 0 to 45 percent
Elevation range: 3,600 to 5,500 feet
Mean annual precipitation: 10 to 15 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Aridic Calciustepts

Typical Pedon

Crago gravelly loam, 0 to 8 percent slopes, in an area of rangeland, 1,000 feet north and 1,600 feet east of the southwest corner of sec. 16, T. 12 N., R. 5 W.

A—0 to 4 inches; light brownish gray (10YR 6/2) gravelly loam, dark brown (10YR 4/3) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 35 percent pebbles; common fine white lime coats on undersides of rock fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—4 to 10 inches; white (10YR 8/2) very gravelly loam, pale brown (10YR 6/3) moist; weak fine and medium angular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 50 percent pebbles; disseminated lime; continuous distinct lime coats on undersides of rock fragments; violently

effervescent; moderately alkaline; gradual smooth boundary.

Bk2—10 to 32 inches; white (10YR 8/2) very gravelly loam, pale brown (10YR 6/3) moist; weak medium and coarse angular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 55 percent pebbles; disseminated lime; continuous distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—32 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; 65 percent pebbles; continuous distinct lime casts on undersides of pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Soil phases: Stony

A horizon
Hue: 5Y, 2.5Y, or 7.5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 60 percent—5 to 30 percent stones and cobbles; 10 to 30 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 5Y, 2.5Y, or 7.5YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 15 to 75 percent—0 to 30 percent stones and cobbles; 15 to 60 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent in the fine earth fraction; 40 percent for the whole soil, including coarse fragments less than 3/4-inch in size
Reaction: pH 7.4 to 8.4

Bk2 and Bk3 horizons
Hue: 2.5Y or 10YR
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam, sandy loam, sandy clay loam, or clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 15 to 30 percent for fine earth fraction; 40 to 70 percent for the whole soil, including coarse rock fragments less than 3/4-inch in size
Reaction: pH 7.4 to 8.4

141E—Crago-Pensore channery loams, 15 to 45 percent slopes

Setting

Landform:
- Crago—Hills
- Pensore—Hills

Position on landform:
- Crago—Backslopes and footslopes
- Pensore—Backslopes and shoulders

Slope:
- Crago—15 to 45 percent
- Pensore—15 to 45 percent

Elevation: 3,800 to 5,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Crago and similar soils: 55 percent
Pensore and similar soils: 35 percent

Minor Components
Whitecow and similar soils: 0 to 3 percent
Musselshell and similar soils: 0 to 3 percent
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 2 percent

Major Component Description

Crago
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

Pensore
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

433E—Crago-Musselshell gravelly loams, 4 to 35 percent slopes

Setting

Landform:
- Crago—Alluvial fans
- Musselshell—Alluvial fans

Slope:
- Crago—4 to 35 percent
- Musselshell—4 to 35 percent

Elevation: 3,600 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Crago and similar soils: 50 percent
Musselshell and similar soils: 40 percent

Minor Components
Amesha and similar soils: 0 to 3 percent
Soils that have slopes more than 35 percent: 0 to 3 percent
Soils with cobbly loam surface layers: 0 to 2 percent
Soils with stony loam surface layers: 0 to 1 percent
Soils shallow to bedrock: 0 to 1 percent

Major Component Description

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

Musselshell
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

637B—Crago gravelly loam, 0 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 8 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Crago and similar soils: 90 percent

Minor Components
Musselshell and similar soils: 0 to 5 percent
Soils with extremely gravelly substratums: 0 to 5 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Crittenden Series

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained

Permeability: Moderate to a depth of 31 inches and rapid below
Landform: Hills and bedrock-floored plains
Parent material: Material derived from granitic rock
Slope range: 4 to 35 percent
Elevation range: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Crittenden sandy loam, in an area of Crittenden-Tolman complex, 4 to 35 percent slopes, in an area of rangeland, 650 feet north and 200 feet east of the southwest corner of sec. 35, T. 11 N., R. 4 W.

A—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft; very friable, slightly sticky, nonplastic; many very fine roots; 5 percent pebbles; slightly acid; clear smooth boundary.

Bt—5 to 20 inches; pale brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; slightly hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; clay bridging between mineral grains; slightly alkaline; gradual smooth boundary.

Bk1—20 to 31 inches; light gray (2.5Y 7/2) gravelly sandy loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 20 percent angular pebbles; common fine soft masses of lime; continuous distinct lime coats on undersides of pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bk2—31 to 50 inches; reddish yellow (7.5YR 6/6) very gravelly loamy coarse sand, brown (7.5YR 5/4) moist; massive; loose, slightly sticky, nonplastic; few very fine roots; 50 percent angular pebbles; common fine soft masses of lime; continuous distinct lime coats on undersides of pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

R—50 inches; hard granitic rock with few cracks.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the sandy-skeletal 2Bk2 horizon: 20 to 40 inches
Depth to the R horizon: 40 to 60 inches

A horizon
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 15 percent angular pebbles
Reaction: pH 6.1 to 7.3

Bt horizon
Value: 5 or 6 dry; 4 moist
Chroma: 3 or 4
Texture: Sandy clay loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 15 percent angular pebbles
Reaction: pH 6.6 to 7.8

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Sandy loam or loam
Clay content: 10 to 20 percent
Content of rock fragments: 10 to 30 percent angular pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

2Bk2 horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4 or 6
Texture: Loamy coarse sand or coarse sand
Clay content: 0 to 5 percent
Content of rock fragments: 35 to 60 percent angular pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

138D—Crittenden-Tolman complex, 4 to 35 percent slopes

Setting

Landform:
- Crittenden—Hills
- Tolman—Hills

Position on landform:
- Crittenden—Backslopes and footslopes
- Tolman—Backslopes and shoulders

Slope:
- Crittenden—4 to 25 percent
- Tolman—4 to 35 percent

Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Crittenden and similar soils: 70 percent
Tolman and similar soils: 25 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Deep, calcareous silt loam soil: 0 to 1 percent

Major Component Description

Crittenden
Surface layer texture: Sandy loam
Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from granitic rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.8 inches

Tolman
Surface layer texture: Sandy clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

738B—Crittenden-Kalsted, bedrock substratum, sandy loams, 2 to 8 percent slopes

Setting

Landform:
- Crittenden—Bedrock-floored plains
- Kalsted—Bedrock-floored plains

Slope:
- Crittenden—2 to 8 percent
- Kalsted—2 to 8 percent

Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Crittenden and similar soils: 50 percent
Kalsted and similar soils: 40 percent

Minor Components
Areas of rock outcrop: 0 to 4 percent
Moderately deep soils: 0 to 3 percent
Very deep loamy soils: 0 to 3 percent

Major Component Description

Crittenden
Surface layer texture: Sandy loam
Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from granitic rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.8 inches

Kalsted
Surface layer texture: Sandy loam
Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from granitic rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Crow Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Mountains
Parent material: Alpine till
Slope range: 4 to 25 percent
Elevation range: 4,600 to 5,000 feet
Mean annual precipitation: 20 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Crow loam, 4 to 25 percent slopes, in an area of forestland, 900 feet south and 100 feet east of the northwest corner of sec. 3, T. 13 N., R. 9 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter of needles and twigs.

E—0 to 6 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; 10 percent cobbles and pebbles; moderately acid; clear smooth boundary.

E/Bt—6 to 12 inches; 70 percent light gray (10YR 7/2) loam, brown (10YR 5/3) moist (E part); 30 percent pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist (B part); moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; many silt and sand skeletans on faces of peds; 10 percent cobbles and pebbles; moderately acid; gradual smooth boundary.

Bt1—12 to 28 inches; light yellowish brown (10YR 6/4) clay, dark brown (7.5YR 4/4) moist; strong medium and coarse angular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous prominent yellowish brown (10YR 5/4) clay films on faces of peds; common flattened dead roots on faces of peds; 5 percent cobbles and pebbles; slightly acid; gradual smooth boundary.

Bt2—28 to 38 inches; light yellowish brown (10YR 6/4) sandy clay, brown (7.5YR 5/4) moist; moderate coarse angular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many prominent dark brown (7.5YR 4/4) moist clay films on faces of peds; common flattened dead roots on faces of peds; slightly acid; gradual smooth boundary.

Bt3—38 to 60 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; few very fine, fine, and medium roots; common very fine tubular and interstitial pores; common distinct dark brown (7.5YR 4/4) moist clay films on faces of peds and clay bridging of sand grains; 10 percent angular cobbles and 25 percent angular pebbles; slightly acid.

Range in Characteristics

Soil temperature: 40 to 47 degrees F

E horizon
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 5.6 to 6.5

E/Bt horizon
Hue: 10YR or 2.5Y
Value: E part—5 or 6 moist; B part—4 or 5 moist
Chroma: E part—2 or 3; B part—2 to 4
Textures: Silty clay loam, clay loam, loam, or silt loam
Clay content: 20 to 40 percent (mixed)
Content of rock fragments: 0 to 25 percent—0 to 5 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 5.6 to 6.5

Bt horizons
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Silty clay, clay, sandy clay, clay loam, or sandy loam
Clay content: 20 to 60 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 6.1 to 7.3

415D—Crow loam, 4 to 25 percent slopes

Setting

Landform: Mountains
Slope: 4 to 25 percent
Elevation: 4,600 to 5,000 feet
Mean annual precipitation: 20 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Crow and similar soils: 85 percent

Minor Components
Soils with stony loam surface layers: 0 to 4 percent
Soils with cobbly loam surface layers: 0 to 4 percent
Soils that have slopes more than 25 percent: 0 to 4 percent
Soils that are deep to soft bedrock: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Cuniff Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Hills and sedimentary plains
Parent material: Material derived from semiconsolidated sandstone
Slope range: 2 to 35 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy, mixed, superactive, frigid, shallow Typic Haplustolls

Typical Pedon

Cuniff fine sandy loam, in an area of Vebar-Cuniff fine sandy loams, 2 to 8 percent slopes, in an area of rangeland, 2,100 feet north and 2,000 feet east of the southwest corner of sec. 15, T. 19 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; slightly alkaline; clear smooth boundary.

Bw—5 to 10 inches; light brownish gray (10YR 6/2) fine sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—10 to 16 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, nonplastic; common very fine roots; common very fine tubular and interstitial pores; 20 percent soft sandstone pebbles; continuous distinct lime coats on undersides of pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Cr—16 to 60 inches; light olive gray (5Y 6/2) semiconsolidated sedimentary beds, olive gray (5Y 5/2) moist; few fine roots between cracks in upper part; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 13 to 20 inches

A horizon
Value: 4 or 5 dry
Chroma: 2 or 3
Clay content: 10 to 18 percent
Reaction: pH 6.6 to 7.8

Bw horizon
Value: 5 or 6 dry
Chroma: 2 to 4
Clay content: 8 to 18 percent
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 8 to 15 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

339D—Cuniff-Rock outcrop complex, 2 to 35 percent slopes

Setting

Landform: Hills
Slope: 2 to 35 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Cuniff and similar soils: 70 percent
Rock outcrop: 20 percent

Minor Components
Areas of blowouts: 0 to 4 percent
Very shallow soils: 0 to 3 percent
Shallow loam textured soils: 0 to 3 percent

Major Component Description

Cuniff
Surface layer texture: Fine sandy loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

Rock outcrop
Definition: Hard and soft sandstone

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

DAM—Dam

Composition

Major Components
Dam: 100 percent

Major Component Description

Definition: A barrier built to hold back flowing water.

Delpoint Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Material derived from semiconsolidated sandstone or siltstone
Slope range: 2 to 60 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Haplustepts

Typical Pedon

Delpoint loam, in an area of Delpoint-Cabbart loams, 8 to 35 percent slopes, in an area of rangeland, 1,100 feet north and 900 feet west of the southeast corner of sec. 2, T. 20 N., R. 6 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak very thin platy parting to weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 18 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent sandstone channers; continuous faint lime casts on undersides of channers; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk—18 to 30 inches; light gray (2.5Y 7/2) sandy loam, yellowish brown (2.5Y 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 20 percent soft sandstone channers; common fine seams and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Cr—30 to 60 inches; pale olive (5Y 6/3) semiconsolidated sedimentary beds, olive (5Y 4/3) moist; few fine roots in cracks in upper part.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 10 to 20 inches
Depth to bedrock: 20 to 40 inches
Other features: When mixed to 7 inches, the A horizon will not meet the requirements for a mollic epipedon.

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 20 to 27 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or silty clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, sandy loam, clay loam, or silty clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 15 to 25 percent
Effervescence: Strongly or violently
Reaction: pH 7.9 to 9.0

257D—Delpoint-Cabbart loams, 8 to 35 percent slopes

Setting

Landform:
- Delpoint—Hills
- Cabbart—Hills

Position on landform:
- Delpoint—Backslopes
- Cabbart—Backslopes and shoulders

Slope:
- Delpoint—8 to 35 percent
- Cabbart—8 to 35 percent

Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Delpoint and similar soils: 60 percent
Cabbart and similar soils: 25 percent

Minor Components
Amesha and similar soils: 0 to 4 percent
Shallow clayey soils: 0 to 4 percent
Areas of rock outcrop: 0 to 4 percent
Moderately deep clayey soils: 0 to 3 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

357D—Delpoint-Marmarth-Tolman complex, 8 to 25 percent slopes

Setting

Landform:
- Delpoint—Hills
- Marmarth—Hills
- Tolman—Hills

Position on landform:
- Delpoint—Backslopes
- Marmarth—Footslopes and toeslopes
- Tolman—Backslopes and shoulders

Slope:
- Delpoint—8 to 25 percent
- Marmarth—8 to 25 percent
- Tolman—8 to 25 percent

Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Delpoint and similar soils: 40 percent
Marmarth and similar soils: 30 percent
Tolman and similar soils: 20 percent

Minor Components
Very shallow soils: 0 to 3 percent
Areas of rock outcrop: 0 to 3 percent
Shallow loam soils: 0 to 3 percent
Deep loam soils: 0 to 1 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Marmarth
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Tolman
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

457C—Delpoint-Amesha loams, 2 to 8 percent slopes

Setting

Landform:
- Delpoint—Sedimentary plains
- Amesha—Sedimentary plains

Position on landform:
- Delpoint—Backslopes and shoulders
- Amesha—Footslopes and toeslopes

Slope:
- Delpoint—2 to 8 percent
- Amesha—2 to 8 percent

Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Delpoint and similar soils: 45 percent
Amesha and similar soils: 40 percent

Minor Components
Cabbart and similar soils: 0 to 5 percent
Sappington and similar soils: 0 to 5 percent
Moderately deep clayey soils: 0 to 5 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Amesha
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

557F—Delpoint-Cabbart-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform:
• Delpoint—Hills
• Cabbart—Hills
Position on landform:
• Delpoint—Backslopes
• Cabbart—Backslopes and shoulders
• Rock outcrop—Backslopes and shoulders
Slope:
• Delpoint—15 to 60 percent
• Cabbart—15 to 60 percent
Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Delpoint and similar soils: 50 percent
Cabbart and similar soils: 35 percent
Rock outcrop: 10 percent

Minor Components
Very deep loamy soils: 0 to 2 percent
Soils that are shallow to hard bedrock: 0 to 2 percent
Shallow soils with gravel: 0 to 1 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Rock outcrop
Definition: Hard sandstone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

300—Dumps, mine

Composition

Major Components
Dumps: 95 percent

Minor Components
Soils that have slopes more than 35 percent: 0 to 3 percent
Soils with less rock fragments: 0 to 2 percent

Major Component Description

Definition: Rock and soil from placer mining activities
Flooding: None

Elbeth Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 38 inches and rapid below
Landform: Mountains
Parent material: Material derived from coarse-grained granite rock
Slope range: 8 to 35 percent
Elevation range: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Elbeth very stony sandy loam, in an area of Woodgulch-Elbeth-Rock outcrop complex, 8 to 35 percent slopes, in an area of forestland, 200 feet north and 1,400 feet west of the southeast corner of sec. 12, T. 9 N., R. 4 W.

A—0 to 4 inches; gray (10YR 5/1) very stony sandy loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky parting to moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and medium roots; many very fine tubular and interstitial pores; common fine flakes of iron pyrite; slightly acid; gradual smooth boundary.
E—4 to 21 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky parting to moderate fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; common medium and few very fine roots; many very fine tubular and interstitial pores; neutral; gradual smooth boundary.
Bt1—21 to 33 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds and clay bridging of sand grains; neutral; gradual smooth boundary.
Bt2—33 to 38 inches; light yellowish brown (2.5Y 6/4) sandy loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds and clay bridging of sand grains; neutral; gradual smooth boundary.
C—38 to 60 inches; light olive gray (5Y 6/2) sand, olive gray (5Y 4/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine roots; neutral.

Range in Characteristics

A horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 3 to 5 dry; 2 to 4 moist
Chroma: 1 to 3
Clay content: 10 to 15 percent
Reaction: pH 6.1 to 7.3

E horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 1 to 3
Clay content: 10 to 15 percent
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy loam or sandy clay loam
Clay content: 5 to 25 percent
Reaction: pH 6.1 to 7.3

C horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sand, coarse sand, or loamy sand
Clay content: 0 to 5 percent
Reaction: pH 6.1 to 7.3

Elve Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium
Slope range: 25 to 60 percent
Elevation range: 5,500 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Eutrocryepts

Typical Pedon

Elve extremely stony sandy loam, 25 to 60 percent slopes, in an area of forestland, 2,100 feet south and 2,000 feet west of the northeast corner of sec. 20, T. 17 N., R. 6 W.

O—2 inches to 0; forested litter of partially decomposed needles and twigs.

E—0 to 13 inches; light yellowish brown (10YR 6/4) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft very friable, slightly sticky, nonplastic; common very fine, fine, and medium roots; many very fine tubular and interstitial pores; 25 percent stones and 40 percent cobbles; moderately acid; clear smooth boundary.

E/Bw—13 to 60 inches; 90 percent light gray (10YR 7/2) very cobbly sandy loam, brown (10YR 5/3) moist (E part); 10 percent light brown (7.5YR 6/4) very cobbly sandy loam, dark brown (7.5YR 4/4) moist (B part); weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, nonplastic; common very fine and fine and few medium roots to 40 inches and few below; many very fine tubular and interstitial pores; 30 percent cobbles and 25 percent pebbles; moderately acid.

Range in Characteristics

Soil temperature: 40 to 45 degrees F

E horizon

Hue: 7.5YR or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 5 to 15 percent
Content of rock fragments: 60 to 85 percent—10 to 25 percent stones; 20 to 40 percent cobbles; 20 to 35 percent pebbles
Reaction: pH 5.1 to 6.5

E/Bw horizon

Hue: 7.5YR or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4 or 6
Texture: Loam or sandy loam
Clay content: 10 to 25 percent
Content of rock fragments: 60 to 85 percent—30 to 40 percent stones and cobbles; 25 to 45 percent pebbles
Reaction: pH 5.1 to 6.5

90F—Elve extremely stony sandy loam, 25 to 60 percent slopes

Setting

Landform: Mountains
Slope: 25 to 60 percent
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Elve and similar soils: 85 percent

Minor Components
Soils that are shallow to bedrock: 0 to 5 percent
Areas of rock outcrop: 0 to 5 percent
Areas of rubble land: 0 to 5 percent

Major Component Description

Surface layer texture: Extremely stony sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Endoaquolls

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained or very poorly drained
Permeability: Variable
Landform: Flood plains and closed depressions
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,500 to 5,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Endoaquolls

Typical Pedon

Endoaquolls, in an area of Fluvaquents-Endoaquolls complex, 0 to 4 percent slopes, in an area of rangeland, 1,700 feet north and 50 feet east of the southwest corner of sec. 14, T. 24 N., R. 9 W.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; slightly effervescent; slightly alkaline; clear smooth boundary.

Bg1—7 to 10 inches; dark grayish brown (10YR 4/2) silt loam, gray (10YR 6/1) dry; common medium distinct mottles yellowish brown (10YR 5/4) moist; moderate thin platy parting to moderate medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many very fine tubular and interstitial pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bg2—10 to 14 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; common medium prominent mottles, strong brown (7.5YR 4/6) moist; massive; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.

Bg3—14 to 22 inches; gray (5Y 5/1) loam, light gray (2.5Y 7/2) dry; common medium prominent mottles, brown (7.5YR 5/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.

C—22 to 60 inches; dark brown (10YR 4/3) extremely gravelly sand, light brownish gray (10YR 6/2) dry; single grain; loose, nonsticky, nonplastic; 5 percent cobbles and 60 percent pebbles; slightly alkaline.

Range in Characteristics

Control section: 10 to 40 inches
Depth to the seasonal high water table: 0 to 24 inches

Fairfield Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Alluvial fans and moraines
Parent material: Alluvium or alpine till
Slope range: 1 to 25 percent
Elevation range: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Fairfield cobbly loam, 1 to 4 percent slopes, in an area of rangeland, 1,850 feet south and 2,450 feet west of the northeast corner of sec. 32, T. 17 N., R. 4 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 15 percent cobbles and 5 percent pebbles; neutral; clear smooth boundary.

Bt—4 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic parting to strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; 10 percent angular pebbles; slightly alkaline; clear smooth boundary.

Btk—10 to 15 inches; pale brown (10YR 6/3) gravelly clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few distinct clay films on faces of peds; common distinct lime coats on faces of peds; 5 percent angular cobbles and 15 percent angular pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—15 to 25 inches; white (10YR 8/2) cobbly clay loam, pale brown (10YR 6/3) moist; weak coarse prismatic parting to weak medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent angular cobbles and 10 percent angular pebbles; disseminated lime; common distinct lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—25 to 40 inches; white (10YR 8/2) gravelly clay loam, pale brown (10YR 6/3) moist; weak coarse prismatic parting to weak coarse subangular blocky structure; hard, friable, moderately sticky,

slightly plastic; few very fine roots; many very fine tubular and interstitial pores; 5 percent angular cobbles and 15 percent angular pebbles; disseminated lime; common distinct lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—40 to 60 inches; very pale brown (10YR 8/3) gravelly clay loam, pale brown (10YR 6/3) moist; massive; hard, friable, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; 10 percent angular cobbles and 15 percent angular pebbles; disseminated lime; common soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the calcic horizon: 7 to 10 inches

A horizon
Hue: 10YR or 7.5YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Content of rock fragments: 15 to 35 percent—10 to 15 percent stones and cobbles; 5 to 20 percent pebbles
Reaction: pH 6.6 to 8.4

Bt horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam or silty clay loam
Clay content: 30 to 35 percent
Electrical conductivity: 0 to 2 mmhos/cm
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 6.6 to 8.4

Btk and Bk1 horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay loam or silty clay loam
Clay content: 27 to 32 percent
Content of rock fragments: 0 to 35 percent—0 to 2 percent cobbles; 0 to 15 percent pebbles
Electrical conductivity: 2 to 4 mmhos/cm
Calcium carbonate equivalent: 15 to 35 percent
Reaction: pH 7.4 to 8.4

Bk2 and Bk3 horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Clay loam or silty clay loam
Clay content: 27 to 32 percent
Content of rock fragments: 0 to 35 percent—0 to 15 percent cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 10 to 30 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

42B—Fairfield cobbly loam, 1 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 1 to 4 percent
Elevation: 4,000 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Fairfield and similar soils: 85 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 4 percent
Soils with calcareous surface layers: 0 to 4 percent
Soils with more rock fragments: 0 to 4 percent
Soils with loam surface layers: 0 to 3 percent

Major Component Description

Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

643D—Fairfield-Beanlake-Winspect stony loams, 2 to 25 percent slopes

Setting

Landform:
- Fairfield—Moraines
- Beanlake—Moraines
- Winspect—Moraines

Position on landform:
- Fairfield—Footslopes and toeslopes
- Beanlake—Backslopes
- Winspect—Backslopes and shoulders

Slope:
- Fairfield—2 to 25 percent
- Beanlake—2 to 25 percent
- Winspect—2 to 25 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Fairfield and similar soils: 45 percent
Beanlake and similar soils: 25 percent
Winspect and similar soils: 15 percent

Minor Components
Regent and similar soils: 0 to 4 percent
Poorly drained soils: 0 to 1 percent
Moderately deep soils: 0 to 4 percent
Very deep noncalcareous soils: 0 to 4 percent
Soils with more rock fragments: 0 to 2 percent

Major Component Description

Fairfield
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.1 inches

Beanlake
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Winspect
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Fairway Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderate to a depth of 45 inches and rapid below
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,600 to 4,800 feet
Mean annual precipitation: 10 to 22 inches
Frost-free period: 70 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Fluvaquentic Haplustolls

Typical Pedon

Fairway silt loam, in an area of Meadowcreek-Fairway complex, 0 to 2 percent slopes, in an area of cropland, 2,100 feet north and 2,400 feet east of the southwest corner of sec. 15, T. 10 N., R. 3 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine, medium, and coarse roots; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

A—8 to 15 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine, medium, and coarse roots; common very

fine tubular and interstitial pores; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—15 to 30 inches; light olive gray (5Y 6/2) silt loam, olive gray (5Y 4/2) moist; weak medium prismatic parting to weak coarse subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine, medium, and coarse roots; common very fine tubular and interstitial pores; few fine seams and soft masses of lime; strongly effervescent; slightly alkaline; clear smooth boundary.

Bg—30 to 45 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; many fine and medium prominent reddish brown (5YR 4/4) moist redox concentrations; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; slightly effervescent; neutral; diffuse wavy boundary.

2Cg—45 to 60 inches; light brownish gray (2.5Y 6/2) sand, dark grayish brown (2.5Y 4/2) moist; few fine and medium prominent dark brown (7.5YR 4/4) moist redox concentrations; single grain; loose, nonsticky, nonplastic; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 10 to 15 inches
Depth to sand, loamy sand, or very gravelly sand: 40 inches or more
Depth to the seasonal high water table: 24 to 42 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Clay content: 15 to 27 percent
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 6.6 to 7.8

A horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 to 3
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist; 6 dry
Chroma: 2 or 3
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 7.8

Bg horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist; 6 dry
Chroma: 1 to 3
Texture: Loam, silt loam, or silty clay loam with thin strata of sandy loam, loamy sand, and clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 15 percent pebbles
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 2 to 10 percent
Reaction: pH 6.6 to 7.8

2Cg horizon
Hue: 2.5Y or 5Y
Value: 3 or 4 moist; 6 dry
Chroma: 1 or 2
Texture: Sand, loamy sand, or sandy loam
Clay content: 0 to 10 percent
Content of rock fragments: 0 to 60 percent—0 to 5 percent cobbles; 0 to 55 percent pebbles
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 6.6 to 7.8

3A—Fairway silt loam, cool, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 20 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Fairway and similar soils: 90 percent

Minor Components
Wabek and similar soils: 0 to 4 percent
Larry and similar soils: 0 to 3 percent
Soils with sand and gravel at 30 inches: 0 to 3 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 8.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

20A—Fairway silt loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Fairway and similar soils: 90 percent

Minor Components
Meadowcreek and similar soils: 0 to 5 percent
Villy and similar soils: 0 to 5 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 8.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

520A—Fairway-Villy silt loams, 0 to 2 percent slopes

Setting

Landform:
- Fairway—Flood plains
- Villy—Flood plains

Position on landform:
- Fairway—Microhighs
- Villy—Microlows

Slope:
- Fairway—0 to 2 percent
- Villy—0 to 2 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Fairway and similar soils: 45 percent
Villy and similar soils: 40 percent

Minor Components
Meadowcreek and similar soils: 0 to 5 percent
Very poorly drained soils: 0 to 5 percent
Soils that have slopes more than 2 percent: 0 to 5 percent

Major Component Description

Fairway
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 8.6 inches

Villy
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained

Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 11.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Farnuf Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and stream terraces
Parent material: Alluvium or glacial till
Slope range: 0 to 25 percent
Elevation range: 3,500 to 5,500 feet
Mean annual precipitation: 15 to 22 inches
Frost-free period: 70 to 110 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Farnuf loam, in an area of Farnuf-Reeder loams, 4 to 10 percent slopes, in an area of rangeland, 1,200 feet north and 1,500 feet west of the southeast corner of sec. 29 T. 19 N., R. 4 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; slightly acid; clear smooth boundary.

Bt1—5 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 2 percent pebbles; slightly acid; gradual smooth boundary.

Bt2—9 to 14 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic parting to strong medium angular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct very dark grayish brown (10YR 3/2) moist clay films on faces of peds; neutral; gradual smooth boundary.

Bt3—14 to 19 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; strong medium prismatic parting to strong medium angular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct dark brown (10YR 3/3) moist clay films on faces of peds; neutral; gradual smooth boundary.

Btk—19 to 26 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; common fine soft masses and seams of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—26 to 38 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic parting to weak medium and coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; many fine soft masses and seams of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—38 to 50 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, slightly plastic; few very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; common fine soft masses and seams of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—50 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; 5 percent pebbles; common fine soft masses and seams of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to secondary lime: 10 to 25 inches

A horizon
Hue: 2.5Y or 10YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 20 percent stones and cobbles; 0 to 15 percent pebbles
Reaction: pH 6.1 to 7.8

Bt horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 3 to 6 dry; 2 to 4 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or silty clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.1 to 7.8

Btk and Bk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, silt loam, silty clay loam, or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

69A—Farnuf loam, 0 to 2 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 2 percent
Elevation: 3,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Farnuf and similar soils: 85 percent

Minor Components
Soils with gravelly loam surface layers: 0 to 4 percent
Soils that have slopes more than 2 percent: 0 to 4 percent
Fairfield and similar soils: 0 to 4 percent
Soils with very gravelly substratums: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

69B—Farnuf loam, 2 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 4 percent
Elevation: 3,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Farnuf and similar soils: 85 percent

Minor Components
Soils with gravelly loam surface layers: 0 to 4 percent
Soils that have slopes more than 4 percent: 0 to 4 percent
Fairfield and similar soils: 0 to 4 percent
Soils with very gravelly substratums: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

69C—Farnuf loam, 4 to 10 percent slopes

Setting

Landform: Alluvial fans
Slope: 4 to 10 percent
Elevation: 3,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Farnuf and similar soils: 90 percent

Minor Components
Soils with gravelly loam surface layers: 0 to 4 percent
Soils that have slopes more than 10 percent: 0 to 4 percent
Soils with very gravelly substratums: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

169C—Farnuf-Reeder loams, 4 to 10 percent slopes

Setting

Landform:
- Farnuf—Alluvial fans
- Reeder—Hills

Slope:
- Farnuf—4 to 10 percent
- Reeder—4 to 10 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Farnuf and similar soils: 70 percent
Reeder and similar soils: 20 percent

Minor Components
Regent and similar soils: 0 to 4 percent
Work and similar soils: 0 to 3 percent
Soils that have slopes more than 10 percent: 0 to 3 percent

Major Component Description

Farnuf
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

Reeder
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

499D—Farnuf-Hilger stony loams, cool, 4 to 25 percent slopes

Setting

Landform:
- Farnuf—Alluvial fans
- Hilger—Moraines

Position on landform:
- Farnuf—Backslopes and footslopes
- Hilger—Backslopes and shoulders

Slope:
- Farnuf—4 to 25 percent
- Hilger—4 to 25 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Farnuf and similar soils: 70 percent
Hilger and similar soils: 25 percent

Minor Components
Soils that have slopes more than 25 percent: 0 to 3 percent
Soils that are poorly drained and ponded: 0 to 1 percent
Soils with sand and gravel at 30 inches: 0 to 1 percent

Major Component Description

Farnuf
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

Hilger
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Fluvaquentic Haplustolls

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderately rapid to moderately slow; rapid in extremely gravelly sand
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 19 inches
Frost-free period: 90 to 120 days

Taxonomic Class: Fluvaquentic Haplustolls

Typical Pedon

Fluvaquentic Haplustolls, in an area of Typic Ustifluvents-Fluvaquentic Haplustolls complex, 0 to 4 percent slopes, in an area of rangeland, 1,850 feet north and 10 feet west of the southeast corner of sec. 2, T. 17 N., R. 4 W.

A—0 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; common worm casts; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bw—11 to 24 inches; light brownish gray (2.5Y 6/2) loam, with thin strata of sandy loam and silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bg1—24 to 40 inches; light brownish gray (2.5Y 6/2) loam with thin strata of silt loam and sandy loam, dark grayish brown (2.5Y 4/2) moist; common fine prominent dark brown (7.5YR 4/4) moist redox concentrations; massive; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; disseminated lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

Bg2—40 to 60 inches; light olive gray (5Y 6/2) sandy loam, dark gray (5Y 4/1) moist; common prominent dark brown (7.5YR 4/4) moist redox concentrations; massive; soft, very friable, slightly sticky, slightly plastic; few very fine roots; disseminated lime; strongly effervescent; strongly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to the seasonal high water table: 24 to 42 inches
Depth to sand and gravel: 20 inches or more

A horizon
Texture: Loam, clay loam, or silty clay loam

Bw horizon
Texture: Loam, clay loam, or sandy loam

Bg horizons
Texture: Loam to extremely gravelly sand

Fluvaquents

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly or poorly drained
Permeability: Variable
Landform: Low stream terraces, closed depressions, and flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,500 to 5,000 feet
Mean annual precipitation: 10 to 25 inches
Frost-free period: 70 to 120 days

Taxonomic Class: Fluvaquents

Typical Pedon

Fluvaquents, in an area of Fluvaquents-Endoaquolls complex, 0 to 4 percent slopes, in an area of rangeland, 1,000 feet south and 50 feet west of the northeast corner of sec. 24, T. 15 N., R. 7 W.

Oi—3 inches to 0; very dark grayish brown (10YR 3/2) organic mat, grayish brown (10YR 5/2) dry; clear smooth boundary.
A—0 to 4 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; many fine prominent strong brown (7.5YR 5/6) moist redox concentrations in the lower part; weak very thin platy parting to weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; slightly acid; clear smooth boundary.
Bg1—4 to 8 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; many medium distinct dark brown (10YR 4/3) moist redox concentrations; moderate very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and few medium roots; many very fine tubular and interstitial pores; slightly acid; clear smooth boundary.
Bg2—8 to 16 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 5/2) dry; common medium distinct dark brown (7.5YR 3/4) moist redox concentrations; weak medium prismatic parting to weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; many very fine and few medium roots; many very fine tubular and interstitial pores; slightly acid; gradual smooth boundary.
Cg1—16 to 40 inches; dark gray (10YR 4/1) silt loam with thin strata of loam, gray (10YR 6/1) dry; common fine and medium prominent strong brown (7.5YR 5/6) moist redox concentrations; massive; slightly hard, very friable, moderately sticky, slightly plastic; common fine and few medium roots; common very fine tubular and interstitial pores; neutral; gradual smooth boundary.
2Cg2—40 to 60 inches; gray (10YR 5/1) gravelly loam, gray (10YR 6/1) dry; common fine and medium prominent strong brown (7.5YR 5/6) moist redox concentrations; massive; slightly hard, very friable, slightly sticky, nonplastic; few fine and medium roots; common very fine tubular and interstitial pores; 25 percent pebbles; neutral.

Range in Characteristics

Control section: 10 to 40 inches
Depth to the seasonal high water table: 0 to 24 inches
Control section texture: Silty clay to very gravelly sandy loam; some pedons may have extremely gravelly sand below a depth of 20 inches.
Salinity: Nonsaline to strongly saline
Sodicity: Nonsodic to moderately sodic
Soil phases: Saline

A horizon
Texture: Silt loam, loam, or silty clay

201B—Fluvaquents, saline, 0 to 4 percent slopes

Setting

Landform: Flood plains
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 19 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Fluvaquents, saline and similar soils: 75 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 5 percent
Well drained soils: 0 to 5 percent
Moderately well drained soils: 0 to 5 percent
Poorly drained soils: 0 to 5 percent

Slightly saline soils: 0 to 3 percent
Nonsaline and nonsodic soils: 0 to 2 percent

Major Component Description

Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

501B—Fluvaquents-Fluvaquentic Haplustolls complex, 0 to 4 percent slopes

Setting

Landform:
- Fluvaquents—Flood plains
- Fluvaquentic Haplustolls—Flood plains

Slope:
- Fluvaquents—0 to 4 percent
- Fluvaquentic Haplustolls—0 to 4 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 19 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Fluvaquents and similar soils: 60 percent
Fluvaquentic Haplustolls and similar soils: 30 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 2 percent
Soils that are shallow to sand and gravel: 0 to 2 percent
Well drained soils: 0 to 2 percent
Soils with gravelly sandy loam surfaces: 0 to 2 percent
Soils with cobbly sandy loam surfaces: 0 to 2 percent

Major Component Description

Fluvaquents
Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional

Fluvaquentic Haplustolls
Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

701B—Fluvaquents-Endoaquolls complex, 0 to 4 percent slopes

Setting

Landform:
- Fluvaquents—Flood plains
- Endoaquolls—Flood plains

Slope:
- Fluvaquents—0 to 4 percent
- Endoaquolls—0 to 4 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Fluvaquents and similar soils: 50 percent
Endoaquolls and similar soils: 35 percent

Minor Components
Very poorly drained soils: 0 to 8 percent
Soils with organic surface layers: 0 to 7 percent

Major Component Description

Fluvaquents
Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Flooding: Occasional

Endoaquolls
Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Flooding: Rare

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Frenchcreek Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 2 to 15 percent
Elevation range: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Haplustolls

Typical Pedon

Frenchcreek very gravelly loam, 2 to 15 percent slopes, in an area of rangeland, 2,000 feet north and 800 feet east of the southwest corner of sec. 29, T. 13 N., R. 3 W.

A—0 to 5 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/3) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 55 percent pebbles; slightly acid; clear smooth boundary.

Bw1—5 to 12 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 60 percent pebbles; slightly acid; gradual smooth boundary.

Bw2—12 to 26 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, slightly sticky, nonplastic; common very fine roots; 70 percent pebbles; slightly acid; gradual smooth boundary.

C1—26 to 36 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose, slightly sticky, nonplastic; few very fine roots; 80 percent pebbles; neutral; gradual smooth boundary.

C2—36 to 60 inches; very pale brown (10YR 7/4) extremely gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, moderately sticky, slightly plastic; 70 percent pebbles; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches; may or may not include part of the Bw horizon

A horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 4 or 5 dry; 3 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 35 to 60 percent—0 to 5 percent cobbles; 35 to 55 percent angular pebbles
Reaction: pH 6.1 to 7.8

Bw1 horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 3 or 4
Texture: Loam or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 30 to 80 percent—0 to 15 percent stones and cobbles; 30 to 65 percent angular pebbles
Reaction: pH 6.1 to 7.8

Bw2 horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 75 percent—0 to 5 percent cobbles; 35 to 70 percent angular pebbles
Reaction: pH 6.1 to 7.8

C1 horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loamy sand or sandy loam
Clay content: 5 to 15 percent
Content of rock fragments: 50 to 80 percent—0 to 5 percent cobbles; 50 to 75 percent angular pebbles
Reaction: pH 6.6 to 7.8

C2 horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 10 to 20 percent
Content of rock fragments: 60 to 80 percent—0 to 5 percent angular cobbles; 60 to 75 percent angular pebbles
Reaction: pH 6.6 to 7.8

288C—Frenchcreek very gravelly loam, 2 to 15 percent slopes

Setting

Landform: Stream terraces
Slope: 2 to 15 percent
Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Frenchcreek and similar soils: 90 percent

Minor Components
Soils with cobbly loam surface layers: 0 to 4 percent
Soils that have slopes more than 15 percent: 0 to 3 percent
Soils with lime accumulation at 30 inches: 0 to 3 percent

Major Component Description

Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Geohrock Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow over moderately rapid
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 2 to 25 percent
Elevation range: 3,600 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Haplustalfs

Typical Pedon

Geohrock gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 1,200 feet south and 1,000 feet east of the northwest corner of sec. 8, T. 11 N., R. 4 W.

A—0 to 4 inches; pinkish gray (7.5YR 6/2) gravelly loam, dark brown (7.5YR 4/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; 20 percent angular pebbles; slightly alkaline; clear smooth boundary.

Bt—4 to 10 inches; brown (10YR 5/3) gravelly clay loam, dark brown (7.5YR 4/3) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds and lining of pores; 30 percent angular pebbles; slightly alkaline; clear smooth boundary.

Btk—10 to 18 inches; brown (7.5YR 5/3) very gravelly loam, dark brown (7.5YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds; 40 percent angular pebbles; many soft masses of lime; continuous faint lime coats on pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk1—18 to 24 inches; light brown (7.5YR 6/4) extremely gravelly loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 60 percent angular pebbles; disseminated lime; continuous distinct lime casts on undersides of pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—24 to 40 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately

sticky, slightly plastic; common very fine roots; 70 percent angular pebbles; disseminated lime; continuous distinct lime casts on undersides of pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

C1—40 to 45 inches; pinkish gray (7.5YR 6/2) extremely gravelly loam, brown (7.5YR 5/2) moist; massive; slightly hard, friable, moderately sticky, slightly plastic; few very fine roots; 80 percent angular pebbles; disseminated lime; slightly effervescent; slightly alkaline; clear smooth boundary.

C2—45 to 60 inches; pinkish gray (7.5YR 6/2) extremely gravelly loam, brown (7.5YR 5/3) moist; massive; slightly hard, friable, moderately sticky, slightly plastic; 60 percent angular pebbles; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Btk or Bk horizon: 6 to 10 inches

A horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles; 15 to 30 percent pebbles or channers
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 27 to 35 percent
Content of rock fragments: 20 to 60 percent—0 to 10 percent cobbles; 20 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

Btk horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 25 to 55 percent—0 to 5 percent angular cobbles; 25 to 50 percent angular pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

Bk horizons
Hue: 5YR, 7.5YR, or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 10 to 25 percent
Content of rock fragments: 60 to 80 percent—0 to 5 percent cobbles; 60 to 75 percent pebbles
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.9 to 8.4

C horizons
Hue: 5YR, 7.5YR, or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 10 to 25 percent
Content of rock fragments: 60 to 80 percent—0 to 10 percent cobbles; 60 to 70 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

89D—Geohrock channery loam, cool, 4 to 25 percent slopes

Setting

Landform: Alluvial fans
Slope: 4 to 25 percent
Elevation: 4,000 to 4,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Geohrock and similar soils: 85 percent

Minor Components
Tolex and similar soils: 0 to 5 percent
Soils that have slopes more than 25 percent: 0 to 5 percent
Soils with calcareous surface layers: 0 to 5 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

163D—Geohrock-Tolman channery loams, 4 to 35 percent slopes

Setting

Landform:
- Geohrock—Alluvial fans
- Tolman—Hills

Slope:
- Geohrock—4 to 25 percent
- Tolman—4 to 35 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Geohrock and similar soils: 55 percent
Tolman and similar soils: 40 percent

Minor Components
Soils that have slopes more than 35 percent: 0 to 1 percent
Areas of rock outcrop: 0 to 1 percent
Crago and similar soils: 0 to 1 percent
Hauz and similar soils: 0 to 1 percent
Soils with less gravel: 0 to 1 percent

Major Component Description

Geohrock
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

Tolman
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

233C—Geohrock-Crago very cobbly loams, 2 to 8 percent slopes

Setting

Landform:
- Geohrock—Alluvial fans
- Crago—Alluvial fans

Slope:
- Geohrock—2 to 8 percent
- Crago—2 to 8 percent

Elevation: 3,600 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Geohrock and similar soils: 60 percent
Crago and similar soils: 30 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 5 percent
Soils that are shallow to sand and gravel: 0 to 5 percent

Major Component Description

Geohrock
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

Crago
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

532B—Geohrock gravelly loam, 2 to 8 percent slopes

Setting

Landform: Stream terraces
Slope: 2 to 8 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Geohrock and similar soils: 85 percent

Minor Components
Crago and similar soils: 0 to 5 percent
Soils that have slopes more than 8 percent: 0 to 5 percent
Soils with sand and gravel at 20 inches: 0 to 5 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Gerdrum Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Alluvial fans, stream terraces, and uplands
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, smectitic, frigid Torrertic Natrustalfs

Typical Pedon

Gerdrum clay loam, in an area of Gerdrum-Nobe-Yamacall complex, 0 to 4 percent slopes, in an area of rangeland, 1,500 feet south and 2,000 feet east of the northwest corner of sec. 36, T. 20 N., R. 4 W.

E—0 to 2 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; moderate very thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; many unstained silt and sand grains; moderately alkaline; abrupt smooth boundary.

Btn—2 to 6 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic parting to strong medium angular blocky structure; very hard, firm, moderately sticky, moderately plastic; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; many unstained sand and silt grains on faces of peds; moderately alkaline; clear smooth boundary.

Btnk—6 to 12 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; strong medium angular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; disseminated lime and few fine soft masses of lime; strongly effervescent; strongly alkaline; clear smooth boundary.

Bkny—12 to 26 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse angular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; common fine seams and masses of gypsum; disseminated lime and few fine masses of lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

Bknyz—26 to 48 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; massive; hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; common fine seams of gypsum and other salts; disseminated lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

C—48 to 60 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, moderately sticky, moderately plastic; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to gypsum: 10 to 28 inches

E horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam (clay loam when mixed to 7 inches)
Clay content: 27 to 40 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Btn horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay, silty clay, clay loam, or silty clay loam
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent pebbles
Structure: Fine to coarse columnar or medium or coarse blocky
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 10 to 20; pedons with sodium adsorption ratio of less than 13 have more exchangeable magnesium plus sodium than calcium plus exchange acidity at pH 8.2.
Reaction: pH 7.4 to 9.0

Btnk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay, silty clay, silty clay loam, or clay loam
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 13 to 20
Reaction: pH 7.4 to 9.0

Bkny and Bknyz horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Clay loam, sandy clay loam, clay, or silty clay
Clay content: 30 to 50 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Gypsum content: 1 to 5 percent
Reaction: pH 7.9 to 9.0

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 3 to 6 moist
Chroma: 1 to 4 (1 chroma is lithochromic.)
Texture: Sandy loam, loam, clay loam, sandy clay loam, or silty clay loam
Clay content: 10 to 35 percent
Content of rock fragments: 15 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Gypsum content: 1 to 5 percent
Reaction: pH 7.9 to 9.0

16B—Gerdrum-Nobe-Yamacall complex, 0 to 4 percent slopes

Setting

Landform:
• Gerdrum—Alluvial fans
• Nobe—Alluvial fans
• Yamacall—Alluvial fans
Slope:
• Gerdrum—0 to 4 percent
• Nobe—0 to 4 percent
• Yamacall—0 to 4 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Gerdrum and similar soils: 60 percent
Nobe and similar soils: 15 percent
Yamacall and similar soils: 15 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 3 percent
Soils that are moderately deep to shale: 0 to 3 percent

Soils with sandstone at 20 to 40 inches: 0 to 2 percent
Poorly drained soils: 0 to 2 percent

Major Component Description

Gerdrum
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.3 inches

Nobe
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 4.6 inches

Yamacall
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Hanson Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium derived from limestone
Slope range: 8 to 45 percent
Elevation range: 6,000 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, carbonatic Calcic Haplocryolls

Typical Pedon

Hanson channery loam, 8 to 35 percent slopes, in an area of rangeland, 1,400 feet north and 700 feet east of the southwest corner of sec. 11, T. 11 N., R. 6 W.

A—0 to 9 inches; dark gray (10YR 4/1) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 20 percent channers; neutral; clear smooth boundary.

Bk1—9 to 30 inches; very pale brown (10YR 7/3) very channery loam, light yellowish brown (10YR 6/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent cobbles and 35 percent channers; continuous prominent lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—30 to 40 inches; very pale brown (10YR 7/3) very channery loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; many very fine tubular and interstitial pores; 20 percent cobbles and 40 percent channers; common fine seams of lime, few soft decomposed limestone fragments and continuous distinct lime crusts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—40 to 60 inches; very pale brown (10YR 7/3) extremely stony loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 25 percent stones, 25 percent cobbles, and 20 percent channers; disseminated lime; continuous distinct lime coats on rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 37 to 44 degrees F
Thickness of the mollic epipedon: 8 to 16 inches
Depth to the calcic horizon: 8 to 16 inches

A horizon
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent flagstones; 15 to 30 percent channers
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 32 percent
Content of rock fragments: 35 to 80 percent—25 to 55 percent stones and cobbles; 10 to 25 percent pebbles or channers
Calcium carbonate equivalent: 30 to 40 percent in the less than 2-mm particle-size fraction; more than 40 percent in the less than 20-mm soil particle-size fraction
Reaction: pH 7.4 to 8.4

23E—Hanson channery loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Hanson and similar soils: 85 percent

Minor Components
Soils with limestone at 20 to 40 inches: 0 to 5 percent
Soils that have slopes more than 35 percent: 0 to 5 percent
Soils with stony surface layers: 0 to 4 percent
Noncalcareous soils: 0 to 1 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

123E—Hanson-Starley channery loams, 15 to 45 percent slopes

Setting

Landform:
- Hanson—Mountains
- Starley—Mountains

Position on landform:
- Hanson—Backslopes
- Starley—Backslopes and shoulders

Slope:
- Hanson—15 to 45 percent
- Starley—15 to 45 percent

Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Hanson and similar soils: 75 percent
Starley and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Soils with less lime: 0 to 1 percent

Major Component Description

Hanson
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.6 inches

Starley
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Hauz Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains and hills
Parent material: Material derived from igneous and argillite bedrock
Slope range: 8 to 45 percent
Elevation range: 4,000 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Hauz channery loam, in an area of Hauz-Sieben-Tolman channery loams, 8 to 45 percent slopes, in an area of rangeland, 1,400 feet south and 1,500 feet east of the northwest corner of sec. 3, T. 12 N., R. 5 W.

A—0 to 5 inches; brown (7.5YR 5/2) channery loam, dark brown (7.5YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; 25 percent channers; slightly acid; clear smooth boundary.

Bt—5 to 15 inches; brown (7.5YR 5/4) very channery clay loam, reddish brown (5YR 4/3) moist; moderate medium prismatic parting to moderate very fine subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds and fragments; 45 percent channers; neutral; gradual smooth boundary.

BC—15 to 24 inches; brown (7.5YR 5/4) extremely channery loam, reddish brown (5YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; 70 percent channers; few faint clay films on faces of peds; neutral; gradual smooth boundary.

R—24 inches; hard fractured bedrock; few fine roots extending into vertical cracks in upper part; few faint lime coats on undersides of some rock fragments.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to bedrock: 20 to 40 inches

A horizon
Hue: 5YR, 7.5YR, or 10YR
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent flagstones; 15 to 30 percent channers
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 3 or 4
Clay content: 27 to 35 percent
Content of rock fragments: 50 to 85 percent—5 to 15 percent flagstones; 45 to 70 percent channers
Reaction: pH 6.1 to 7.8

BC horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 10 to 25 percent
Content of rock fragments: 60 to 80 percent—10 to 20 percent flagstones; 50 to 60 percent channers
Reaction: pH 6.6 to 7.8

263E—Hauz-Sieben-Tolman channery loams, 8 to 45 percent slopes

Setting

Landform:
• Hauz—Mountains
• Sieben—Mountains
• Tolman—Mountains
Position on landform:
• Hauz—Backslopes
• Sieben—Backslopes and footslopes
• Tolman—Backslopes and shoulders
Slope:
• Hauz—8 to 45 percent
• Sieben—8 to 35 percent
• Tolman—8 to 45 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Hauz and similar soils: 35 percent
Sieben and similar soils: 30 percent
Tolman and similar soils: 25 percent

Minor Components
Mocmont and similar soils: 0 to 3 percent
Crago and similar soils: 0 to 3 percent
Soils that have slopes more than 45 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 1 percent
Soils with less rock fragments: 0 to 1 percent

Major Component Description

Hauz
Surface layer texture: Channery loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.7 inches

Sieben
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.3 inches

Tolman
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Havre Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains and low stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, frigid Aridic Ustifluvents

Typical Pedon

Havre silt loam, 0 to 2 percent slopes, in an area of cropland, 2,200 feet south and 900 feet west of the northeast corner of sec. 1, T. 21 N., R. 7 W.

Ap—0 to 6 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky parting to weak very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

A—6 to 20 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic parting to weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine and few medium roots; many very fine tubular and interstitial pores; common worm casts and molds; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1—20 to 40 inches; light brownish gray (2.5Y 6/2) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; common worm casts and molds; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—40 to 55 inches; light brownish gray (2.5Y 6/2) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; few very fine and medium roots; common very fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—55 to 60 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F

A horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silt loam or silty clay
Clay content: 15 to 55 percent
Calcium carbonate equivalent: 1 to 5 percent
Effervescence: None to strongly
Electrical conductivity: 0 to 2 mmhos/cm
Sodium adsorption ratio: 0 to 4
Reaction: pH 6.1 to 8.4

C1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, silt loam, or clay loam, consisting of strata of silt loam, fine sandy loam, silty clay loam, or clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 1 to 10 percent
Effervescence: Slightly or strongly
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 0 to 13
Reaction: pH 7.4 to 9.0

C2 and C3 horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, sandy loam, silt loam, or clay loam, consisting of strata of silt loam, fine sandy loam, silty clay loam, or clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 1 to 10 percent
Effervescence: Slightly or strongly
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 0 to 13
Reaction: pH 7.4 to 9.0

17A—Havre silt loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Havre and similar soils: 85 percent

Minor Components
Soils with sand and gravel substratums: 0 to 5 percent
Silty clay loam soils: 0 to 5 percent
Silty clay soils: 0 to 5 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

217A—Havre silty clay, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Havre and similar soils: 85 percent

Minor Components
Soils with silty clay loam surface layers: 0 to 5 percent
Soils with sand and gravel at deep depths: 0 to 5 percent
Very deep clayey soils: 0 to 5 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Flooding: Rare
Available water capacity: Mainly 9.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Helmville Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Mountains
Parent material: Colluvium and alluvium derived from limestone, argillite, or igneous rock
Slope range: 15 to 60 percent
Elevation range: 5,000 to 7,000 feet
Mean annual precipitation: 19 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Eutric Haplocryalfs

Typical Pedon

Helmville channery loam, 25 to 60 percent slopes, in an area of forestland, 1,100 feet south and 200 feet west of the northeast corner of sec. 20, T. 16 N., R. 6 W.

Oi—2 inches to 0; forest litter of partially decomposed needles, twigs, and roots.

E1—0 to 5 inches; pinkish gray (7.5YR 6/2) channery loam, dark brown (7.5YR 4/3) moist; weak very thin platy parting to weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many silt and sand skeletans on faces of peds; 20 percent channers; moderately acid; clear smooth boundary.

E2—5 to 10 inches; very pale brown (10YR 7/3) channery loam, yellowish brown (10YR 5/4) moist; weak very thin platy parting to weak very fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; 15 percent channers; moderately acid; gradual smooth boundary.

Bt—10 to 25 inches; light yellowish brown (10YR 6/4) very channery clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 10 percent angular cobbles and 50 percent channers; slightly alkaline; gradual smooth boundary.

Bk—25 to 60 inches; pale yellow (2.5Y 7/4) extremely cobbly loam, light olive brown (2.5Y 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine, fine, and medium roots; many very fine tubular and interstitial pores; 10 percent stones, 40 percent angular cobbles, and 15 percent channers; continuous distinct lime casts on undersides of rock fragments; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 37 to 42 degrees F
Depth to the accumulation of carbonates: 15 to 40 inches
Soil phases: Channery and warm

E horizons
Hue: 10YR or 7.5YR
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Content of rock fragments, flat or subrounded: 15 to 35 percent—0 to 20 percent stones, flagstones, and cobbles; 5 to 30 percent pebbles or channers
Reaction: pH 5.6 to 7.3

Bt horizon
Hue: 10YR or 7.5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 4 or 6
Clay content: 27 to 35 percent
Content of rock fragments, flat or subrounded: 30 to 60 percent—10 to 35 percent stones and cobbles; 15 to 50 percent pebbles or channers
Reaction: pH 6.1 to 7.8

Bk horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 3, 4, or 6
Texture: Loam, sandy loam, or clay loam
Clay content: 18 to 30 percent

Content of rock fragments, flat or subrounded:
40 to 90 percent—15 to 45 percent stones and cobbles; 20 to 45 percent pebbles or channers
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.4 to 8.4

196F—Helmville-Swiftcurrent complex, 25 to 60 percent slopes

Setting

Landform:
- Helmville—Mountains
- Swiftcurrent—Mountains

Position on landform:
- Helmville—Backslopes and shoulders
- Swiftcurrent—Backslopes

Slope:
- Helmville—25 to 60 percent
- Swiftcurrent—25 to 60 percent

Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Helmville and similar soils: 50 percent
Swiftcurrent and similar soils: 40 percent

Minor Components
Cowood and similar soils: 0 to 4 percent
Moderately deep soils: 0 to 3 percent
Soils that are shallow to lime: 0 to 3 percent

Major Component Description

Helmville
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.6 inches

Swiftcurrent
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

390F—Helmville channery loam, 25 to 60 percent slopes

Setting

Landform: Mountains
Slope: 25 to 60 percent
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Helmville and similar soils: 85 percent

Minor Components
Cowood and similar soils: 0 to 5 percent
Tigeron and similar soils: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

590E—Helmville channery loam, warm, 15 to 30 percent slopes

Setting

Landform: Mountains
Slope: 15 to 30 percent

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Helmville and similar soils: 85 percent

Minor Components
Moderately deep soils: 0 to 4 percent
Areas of rock outcrop: 0 to 4 percent
Soils that have slopes more than 30 percent: 0 to 4 percent
Soils that are shallow to lime: 0 to 3 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

590F—Helmville channery loam, warm, 30 to 60 percent slopes

Setting

Landform: Mountains
Slope: 30 to 60 percent
Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Helmville and similar soils: 85 percent

Minor Components
Moderately deep soils: 0 to 5 percent
Areas of rock outcrop: 0 to 5 percent
Soils that are shallow to lime: 0 to 5 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Hilger Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and moraines
Parent material: Alluvium or alpine till
Slope range: 2 to 45 percent
Elevation range: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 70 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Hilger stony loam, in an area of Hilger-Farnuf stony loams, 8 to 35 percent slopes, in an area of rangeland, 2,300 feet north and 2,400 feet west of the southeast corner of sec. 2, T. 9 N., R. 5 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 10 percent stones, 5 percent cobbles, and 5 percent pebbles; neutral; clear smooth boundary.

Bt1—6 to 10 inches; dark brown (10YR 4/3) very cobbly clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct very dark grayish brown (10YR 3/2) moist clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; neutral; gradual smooth boundary.

Bt2—10 to 20 inches; yellowish brown (10YR 5/4) very cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct very dark grayish brown (10YR 3/2) moist clay films on faces of peds; clay bridging of sand grains; 20 percent cobbles and 20 percent pebbles; neutral; gradual smooth boundary.

Btk—20 to 28 inches; light brown (7.5YR 6/4) very cobbly clay loam, brown (7.5YR 5/4) moist; moderate medium prismatic parting to moderate coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; common medium soft masses of lime; continuous distinct lime casts on undersides of rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bk—28 to 50 inches; white (10YR 8/2) very cobbly loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 25 percent cobbles and 15 percent pebbles; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

BC—50 to 60 inches; reddish yellow (7.5YR 6/6) very cobbly loam, brown (7.5YR 5/4) moist; massive; hard, friable, moderately sticky, slightly plastic; few very fine roots; 30 percent cobbles and 20 percent pebbles; few fine soft masses of white lime; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches
Depth to the calcic horizon: 13 to 24 inches
Soil phases: Very stony

A horizon
Hue: 7.5YR or 10YR
Value: 3 or 4 dry; 2 or 3 moist
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent—10 to 35 percent boulders, stones, and cobbles; 5 to 25 percent pebbles
Content of rock fragments, surface area: 0.01 to 3 percent boulders and stones
Reaction: pH 6.6 to 7.8

Bt horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 35 to 80 percent—35 to 60 percent boulders, stones, and cobbles;
10 to 30 percent pebbles
Reaction: pH 7.4 to 8.4

Btk and Bk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, sandy loam, or clay loam
Clay content: 15 to 35 percent
Content of rock fragments: 35 to 85 percent—25 to 70 percent boulders, stones, and cobbles; 15 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 8.4

BC horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4, 6
Texture: Loam, sandy loam, or clay loam
Clay content: 15 to 30 percent
Content of rock fragments: 35 to 80 percent—25 to 70 percent boulders, stones, and cobbles; 15 to 35 percent pebbles
Reaction: pH 7.9 to 8.4

100E—Hilger extremely stony loam, 8 to 45 percent slopes

Setting

Landform: Mountains
Slope: 8 to 45 percent
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Hilger and similar soils: 85 percent

Minor Components
Farnuf and similar soils: 0 to 5 percent
Soils with stony surface layers: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Areas of rubble land: 0 to 2 percent

Soils with sand and gravel at 30 inches: 0 to 2 percent
Poorly drained soils: 0 to 2 percent

Major Component Description

Surface layer texture: Extremely stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

567B—Hilger stony loam, 2 to 8 percent slopes

Setting

Landform: Stream terraces
Slope: 2 to 8 percent
Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 105 days

Composition

Major Components
Hilger and similar soils: 85 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 5 percent
Soils with sand and gravel at 30 inches: 0 to 5 percent
Soils that are calcareous throughout: 0 to 5 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

567D—Hilger-Farnuf stony loams, 8 to 35 percent slopes

Setting

Landform:
- Hilger—Alluvial fans
- Farnuf—Alluvial fans

Slope:
- Hilger—8 to 35 percent
- Farnuf—8 to 25 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Hilger and similar soils: 45 percent
Farnuf and similar soils: 40 percent

Minor Components
Soils shallow to bedrock: 0 to 5 percent
Soils with very stony surface layers: 0 to 5 percent
Soils that are calcareous throughout: 0 to 5 percent

Major Component Description

Hilger
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.8 inches

Farnuf
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

961E—Hilger-Regent-Castner stony loams, 15 to 35 percent slopes

Setting

Landform:
- Hilger—Hills
- Regent—Hills
- Castner—Hills

Position on landform:
- Hilger—Backslopes and footslopes
- Regent—Backslopes
- Castner—Backslopes and shoulders

Slope:
- Hilger—15 to 35 percent
- Regent—15 to 35 percent
- Castner—15 to 35 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Hilger and similar soils: 40 percent
Regent and similar soils: 35 percent
Castner and similar soils: 20 percent

Minor Components
Reeder and similar soils: 0 to 1 percent
Cabba and similar soils: 0 to 1 percent
Areas of rock outcrop: 0 to 1 percent
Very shallow soils: 0 to 1 percent
Shallow clayey soils: 0 to 1 percent

Major Component Description

Hilger
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.9 inches

Regent
Surface layer texture: Stony loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Castner
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Holter Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountains
Parent material: Colluvium derived from igneous and argillite bedrock
Slope range: 8 to 45 percent
Elevation range: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Holter channery loam, in an area of Holter-Castner channery loams, 8 to 45 percent slopes, in an area of rangeland, 600 feet south and 700 feet west of the northeast corner of sec. 2, T. 13 N., R. 5 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR

3/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores; 20 percent channers; moderately acid; gradual smooth boundary.

A2—8 to 12 inches; brown (10YR 5/3) very channery loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores; 55 percent channers; moderately acid; gradual smooth boundary.

Bt1—12 to 28 inches; yellowish brown (10YR 5/4) extremely channery clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and few fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 65 percent channers; slightly acid; gradual smooth boundary.

Bt2—28 to 42 inches; brown (10YR 5/3) extremely channery clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine tubular and interstitial pores; common distinct clay films on faces of peds and clay bridging of sands; 65 percent channers; slightly acid; clear smooth boundary.

Bk—42 to 60 inches; brown (10YR 5/3) extremely channery loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and few fine roots to 50 inches and few very fine roots below; many very fine tubular and interstitial pores; 60 percent channers; continuous faint lime casts on undersides of rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bk horizon: 25 to 50 inches

A1 horizon
Hue: 7.5YR or 10YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent flagstones; 15 to 30 percent channers
Reaction: pH 5.6 to 7.3

A2 horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 4 or 5 dry; 3 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 40 to 65 percent—0 to 5 percent flagstones; 40 to 60 percent channers
Reaction: pH 5.6 to 7.3

Bt horizons
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 3 or 4
Texture: Loam or clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 60 to 80 percent—5 to 10 percent flagstones; 55 to 75 percent channers
Reaction: pH 6.1 to 7.3

Bk horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4 or 6
Texture: Loam or sandy clay loam
Clay content: 10 to 25 percent
Content of rock fragments: 60 to 80 percent—5 to 10 percent flagstones; 55 to 75 percent channers
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

61E—Holter-Castner channery loams, 8 to 45 percent slopes

Setting

Landform:
• Holter—Hills
• Castner—Hills
Position on landform:
• Holter—Backslopes and footslopes
• Castner—Backslopes and shoulders
Slope:
• Holter—8 to 45 percent
• Castner—8 to 45 percent
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Holter and similar soils: 60 percent
Castner and similar soils: 25 percent

Minor Components
Mocmont and similar soils: 0 to 5 percent
Soils that have slopes more than 45 percent: 0 to 3 percent
Areas of rock outcrop: 0 to 3 percent
Very shallow soils: 0 to 2 percent
Moderately deep soils: 0 to 2 percent

Major Component Description

Holter
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Kalsted Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Alluvial fans and bedrock-floored plains
Parent material: Alluvium
Slope range: 2 to 8 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Kalsted sandy loam, in an area of Kalsted-Chinook sandy loams, 2 to 8 percent slopes, in an area of rangeland, 1,900 feet north and 1,600 feet west of the southeast corner of sec. 31, T. 11 N., R. 1 W.

A—0 to 3 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.
Bw—3 to 5 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, nonplastic; many very fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.
Bk1—5 to 12 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous faint lime casts on undersides of pebbles; disseminated lime; common distinct lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.
Bk2—12 to 36 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak medium and coarse prismatic parting to weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous distinct lime coats on pebbles; disseminated lime; many distinct lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.
Bk3—36 to 60 inches; very pale brown (10YR 7/3) gravelly fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 25 percent pebbles; disseminated lime; continuous distinct lime coats on pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Bk horizon: 5 to 12 inches
Soil phases: Bedrock substratum

A horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 5 to 18 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sandy loam or loamy sand
Clay content: 5 to 18 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Texture: Fine sandy loam or sandy loam with thin strata of loam, very fine sandy loam, and silt loam (more than 50 percent fine and coarser sand)
Clay content: 5 to 18 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.4 to 8.4

Bk2 and Bk3 horizons
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Fine sandy loam or sandy loam stratified with more than 50 percent fine and coarser sand
Clay content: 5 to 15 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 8.4

236B—Kalsted-Chinook sandy loams, 2 to 8 percent slopes

Setting

Landform:
- Kalsted—Alluvial fans
- Chinook—Alluvial fans

Slope:
- Kalsted—2 to 8 percent
- Chinook—2 to 8 percent

Elevation: 3,500 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Kalsted and similar soils: 50 percent
Chinook and similar soils: 40 percent

Minor Components
Soils that are very gravelly throughout: 0 to 4 percent
Soils that are very gravelly at 2 feet: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 3 percent

Major Component Description

Kalsted
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.5 inches

Chinook
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Kobase Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,500 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, smectitic, frigid Torrertic Haplustepts

Typical Pedon

Kobase silty clay, 0 to 2 percent slopes, in an area of cropland, 800 feet north and 2,500 feet east of the southwest corner of sec. 4, T. 15 N., R. 3 W.

Ap1—0 to 3 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Ap2—3 to 8 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium and coarse angular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; common very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bw—8 to 12 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; weak medium and coarse angular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—12 to 36 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic parting to weak medium angular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; few faint seams of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bky—36 to 60 inches; gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; few medium brown (7.5YR 5/4) moist mottles; weak medium angular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; common distinct seams and soft masses of lime; few seams of gypsum; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 12 to 17 inches
Depth to the Bky horizon: 20 to 40 inches

Ap horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 40 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 0 to 10 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

Bky horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 0 to 4 mmhos/cm
Gypsum content: 1 to 5 percent
Reaction: pH 7.9 to 9.0

130A—Kobase silty clay, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,500 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Kobase and similar soils: 95 percent

Minor Components
Soils with sand and gravel substratums: 0 to 5 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Korell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Low stream terraces and flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,500 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Fluventic Haplustolls

Typical Pedon

Korell loam, 0 to 2 percent slopes, protected, in an area of cropland, 1,100 feet north and 50 feet east of the southwest corner of sec. 11, T. 15 N., R. 3 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

A—6 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—9 to 24 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 3/2) moist; weak medium and coarse angular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; strongly effervescent; strongly alkaline; clear smooth boundary.

C1—24 to 34 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, moderately sticky, slightly plastic; few very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; strongly alkaline; clear smooth boundary.

C2—34 to 60 inches; light brownish gray (2.5Y 6/2) stratified silt loam and loam, grayish brown (2.5Y 5/2) moist; few fine distinct strong brown (7.5YR 5/6) redox concentrations; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; few fine seams and soft masses of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Other features: The organic carbon decreases irregularly with depth.

A horizons
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 18 to 27 percent
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.4 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Sodium adsorption ratio: 5 to 13
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

C horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Loam, fine sandy loam, or silt loam

Clay content: 18 to 27 percent
Calcium carbonate equivalent: 5 to 15 percent
Sodium adsorption ratio: 5 to 13
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.9 to 9.0

12A—Korell loam, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Korell and similar soils: 95 percent

Minor Components
Fairway and similar soils: 0 to 2 percent
Very deep sandy loam soils: 0 to 2 percent
Soils with sand and gravel at 30 inches: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 10.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

112A—Korell loam, 0 to 2 percent slopes, protected

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Korell and similar soils: 95 percent

Minor Components
Fairway and similar soils: 0 to 2 percent
Very deep sandy loam soils: 0 to 2 percent
Soils with sand and gravel at 50 inches: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

LF—Landfill

Composition

Major Components
Landfill: 100 percent

Major Component Description

Definition: Areas where refuse is processed and buried.

Lap Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains and hills
Parent material: Material derived from limestone
Slope range: 8 to 45 percent
Elevation range: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Lithic Calciustolls

Typical Pedon

Lap channery loam, in an area of Windham-Lap channery loams, 8 to 45 percent slopes, in an area of rangeland, 2,400 feet south and 300 feet west of the northeast corner of sec. 29, T. 12 N., R. 5 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 25 percent channers; slightly alkaline; clear smooth boundary.

Bk1—6 to 8 inches; grayish brown (10YR 5/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 30 percent channers; disseminated lime; continuous distinct lime casts on undersides of channers; strongly effervescent; strongly alkaline; clear smooth boundary.

Bk2—8 to 14 inches; very pale brown (10YR 7/3) extremely channery loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 65 percent channers; disseminated lime; continuous prominent lime casts on undersides of channers; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—14 inches; hard limestone bedrock with few cracks.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the R horizon: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent flagstones; 15 to 30 percent channers
Calcium carbonate equivalent: 0 to 15 percent in the less than 2-mm particle-size fraction; more than 40 percent in the less than 20-mm particle-size class
Reaction: pH 6.6 to 7.8

Bk1 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 35 to 70 percent—0 to 30 percent stones, flagstones, or cobbles; 30 to 55 percent pebbles or channers
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 50 to 70 percent—25 to 35 percent stones, flagstones, or cobbles; 35 to 60 percent pebbles or channers
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

264F—Lap-Windham-Rock outcrop complex, 15 to 45 percent slopes

Setting

Landform:
- Lap—Hills
- Windham—Hills

Position on landform:
- Lap—Backslopes and shoulders
- Windham—Backslopes and footslopes
- Rock outcrop—Backslopes and shoulders

Slope:
- Lap—15 to 45 percent
- Windham—15 to 45 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Lap and similar soils: 55 percent
Windham and similar soils: 25 percent
Rock outcrop: 15 percent

Minor Components
Whitecow and similar soils: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 1 percent
Soils with stony loam surface layers: 0 to 1 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Lap
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Windham
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Rock outcrop
Definition: Hard limestone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Larry Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Low stream terraces and flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Endoaquolls

Typical Pedon

Larry silt loam, cool, 0 to 2 percent slopes, in an area of hayland, 2,400 feet south and 1,500 feet west of the northeast corner of sec. 18, T. 14 N., R. 8 W.

A—0 to 8 inches; very dark gray (5Y 3/1) silt loam, gray (5Y 5/1) dry; moderate very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and few medium roots; strongly effervescent; slightly alkaline; clear smooth boundary.

Bg1—8 to 13 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; common fine and medium prominent yellowish brown (10YR 5/6) moist redox concentrations; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and few medium roots; many very fine tubular and interstitial pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bg2—13 to 20 inches; light brownish gray (10YR 6/2) silt loam with thin strata of sandy loam, light gray (10YR 7/2) dry; many fine and medium prominent yellowish brown (10YR 5/6) moist redox concentrations; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and few medium roots; common very fine tubular and interstitial pores; slightly alkaline; gradual smooth boundary.

Cg—20 to 60 inches; gray (10YR 6/1) loam with thin strata of sandy loam and silt loam, light gray (10YR 7/1) dry; many fine and medium prominent yellowish brown (10YR 5/6) moist redox concentrations; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and medium roots; common very fine tubular and interstitial pores; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 46 degrees F
Thickness of the mollic epipedon: 8 to 18 inches
Depth to the seasonal high water table: 12 to 24 inches

A horizon
Hue: 5Y or N
Value: 2 or 3 moist 3 to 5 dry
Chroma: 0 or 1
Clay content: 18 to 27 percent
Effervescence: None to strongly
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.1 to 7.8

Bg horizons
Hue: 10YR or N
Value: 3 to 6 moist; 4, 6, or 7 dry
Chroma: 0 to 2
Texture: Clay loam, silt loam, or loam; may have thin strata of sandy loam
Clay content: 20 to 35 percent with more than 15 percent fine and coarser sand
Reaction: pH 6.6 to 7.8

Cg horizon
Hue: 10YR, 2.5Y, or N
Value: 5 or 6 moist; 4, 6, or 7 dry
Chroma: 0 to 2
Redox concentrations: 10YR 5/6 or 10YR 4/6
Texture: Clay loam, silt loam, or loam with strata of sandy loam
Clay content: 20 to 35 percent with more than 15 percent fine and coarser sand
Reaction: pH 6.6 to 7.8

2A—Larry silt loam, cool, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Larry and similar soils: 95 percent

Minor Components
Fairway, cool soils: 0 to 3 percent
Soils that have very gravelly sand at 2 feet: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 12 to 24 inches
Available water capacity: Mainly 10.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Leavitt Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains and hills
Parent material: Alluvium or alpine till
Slope range: 4 to 30 percent
Elevation range: 4,800 to 6,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Ustic Argicryolls

Typical Pedon

Leavitt stony loam, in an area of Leavitt-Libeg stony loams, 4 to 30 percent slopes, in an area of rangeland, 1,100 feet north and 50 feet east of the southwest corner of sec. 6, T. 18 N., R. 7 W.

A1—0 to 3 inches; very dark gray (10YR 3/1) stony loam, black (10YR 2/1) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent stones and cobbles and 10 percent pebbles; slightly acid; clear smooth boundary.
A2—3 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; slightly acid; clear smooth boundary.
Bt1—7 to 19 inches; brown (10YR 5/3) clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium prismatic parting to moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct dark brown (7.5YR 3/2) clay films on faces of peds; 10 percent pebbles; slightly acid; gradual smooth boundary.
Bt2—19 to 30 inches; brown (7.5YR 5/4) cobbly clay loam, brown (7.5YR 4/4) moist; moderate medium prismatic structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; 15 percent cobbles and 15 percent pebbles; slightly acid; gradual smooth boundary.
Btk—30 to 36 inches; light brownish gray (2.5Y 6/2) cobbly clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic parting to weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular

and interstitial pores; few faint clay films on faces of peds; 10 percent cobbles and 15 percent pebbles; continuous faint lime casts on undersides of coarse rock fragments; common fine seams and soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—36 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; hard, very friable, moderately sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; 15 percent cobbles and 30 percent pebbles; continuous faint lime casts on undersides of rock fragments; common fine seams and soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 36 to 44 degrees F
Thickness of the mollic epipedon: 7 to 15 inches

A horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent stones, cobbles, and pebbles
Reaction: pH 6.6 to 7.3

Bt horizons
Hue: 5YR, 7.5YR, 10YR, or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 1 to 4
Texture: Clay loam or silty clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

Btk horizon
Hue: 5YR, 7.5YR, 10YR, or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Clay loam or silty clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 5 to 35 percent cobbles and pebbles
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 5YR, 7.5YR, 10YR, or 2.5Y
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy clay loam
Clay content: 15 to 40 percent
Content of rock fragments: 35 to 60 percent cobbles and pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

299D—Leavitt-Libeg stony loams, 4 to 30 percent slopes

Setting

Landform:
- Leavitt—Hills
- Libeg—Hills

Slope:
- Leavitt—4 to 30 percent
- Libeg—4 to 30 percent

Elevation: 4,800 to 6,000 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Leavitt and similar soils: 70 percent
Libeg and similar soils: 25 percent

Minor Components
Cheadle and similar soils: 0 to 2 percent
Soils that have slopes more than 30 percent: 0 to 1 percent
Moderately deep soils: 0 to 1 percent
Soils with gravelly loam surface layers: 0 to 1 percent

Major Component Description

Leavitt
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Libeg
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Len Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 1 to 8 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Clayey over loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Len cobbly loam, 1 to 8 percent slopes, in an area of rangeland, 10 feet north and 100 feet west of the southeast corner of sec. 25, T. 17 N., R. 6 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 10 percent cobbles and 10 percent pebbles; neutral; clear smooth boundary.

Bt1—3 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine and medium granular structure; slightly hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 5 percent pebbles; neutral; gradual smooth boundary.

Bt2—7 to 17 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong medium prismatic parting to strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct dark brown (10YR 3/3) moist clay films on faces of peds; 5 percent pebbles; neutral; gradual smooth boundary.

2Btk—17 to 22 inches; pale brown (10YR 6/3) very gravelly sandy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 10 percent cobbles and 40 percent pebbles; common fine soft masses of lime; continuous faint lime coats on rock fragments and continuous faint casts on undersides of rock fragments; strongly effervescent; slightly alkaline; clear smooth boundary.

2Bk1—22 to 40 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky, nonplastic; few very fine roots; common very fine tubular and interstitial pores; 10 percent cobbles and 50 percent pebbles; common fine seams and soft masses of lime; continuous faint lime casts on undersides of rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.

2Bk2—40 to 60 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; 10 percent cobbles and 50 percent pebbles; disseminated lime; continuous faint lime casts on undersides of rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the 2Btk horizon: 11 to 24 inches

A horizon
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Content of rock fragments: 15 to 25 percent—5 to 10 percent cobbles; 10 to 15 percent pebbles
Reaction: pH 6.6 to 7.3

Bt1 horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 35 to 40 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent pebbles
Reaction: pH 6.6 to 7.3

Bt2 horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Texture: Clay loam or clay
Clay content: 35 to 45 percent

Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent pebbles
Reaction: pH 7.4 to 8.4

2Btk horizon
Hue: 5Y, 2.5Y, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Texture: Sandy clay loam or clay loam
Clay content: 30 to 35 percent
Content of rock fragments: 35 to 60 percent—5 to 15 percent cobbles; 30 to 45 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

2Bk horizons
Hue: 5Y, 2.5Y, or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Texture: Sandy loam or loam
Clay content: 5 to 10 percent
Content of rock fragments: 55 to 85 percent—10 to 30 percent cobbles; 45 to 55 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

944B—Len cobbly loam, 1 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 1 to 8 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Len and similar soils: 95 percent

Minor Components
Soils with no fragments: 0 to 3 percent
Soils with very gravelly upper subsoils: 0 to 2 percent

Major Component Description

Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Libeg Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains and hills
Parent material: Colluvium, alluvium, or alpine till
Slope range: 4 to 45 percent
Elevation range: 4,600 to 7,800 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Libeg very channery loam, in an area of Libeg-Cheadle-Rock outcrop complex, 15 to 45 percent slopes, in an area of rangeland, 200 feet north and 1,200 feet east of the southwest corner of sec. 30, T. 14 N., R. 5 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) very channery loam, black (10YR 2/1) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and common fine roots; 45 percent channers; moderately acid; clear smooth boundary.

A2—5 to 15 inches; dark grayish brown (10YR 4/2) very channery loam, very dark brown (10YR 2/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and common fine roots; 45 percent channers; moderately acid; clear smooth boundary.

Bt1—15 to 20 inches; light brown (7.5YR 6/4) very channery clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; few distinct

clay films on faces of peds; 55 percent channers; moderately acid; gradual smooth boundary.

Bt2—20 to 40 inches; light brown (7.5YR 6/4) extremely channery clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 10 percent cobbles and 55 percent channers; moderately acid; gradual smooth boundary.

BC—40 to 60 inches; reddish brown (5YR 5/4) extremely channery loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent cobbles and 50 percent channers; neutral.

Range in Characteristics

Soil temperature: 36 to 44 degrees F
Thickness of the mollic epipedon: 8 to 16 inches
Content of rock fragments: Mainly argillite, igneous, quartzite, and sandstone

A horizons
Hue: 7.5YR or 10YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 10 to 27 percent
Content of rock fragments: 15 to 60 percent—0 to 50 percent stones and cobbles; 5 to 50 percent pebbles or channers
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 5YR, 7.5YR, or 10YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4 or 6
Texture: Loam, sandy loam, or clay loam
Clay content: 15 to 32 percent
Content of rock fragments: 35 to 80 percent—5 to 50 percent stones and cobbles; 10 to 45 percent pebbles
Reaction: pH 6.1 to 7.3

BC horizon
Hue: 5YR or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 4 or 6
Texture: Sandy loam, sandy clay loam, or loam
Clay content: 10 to 20 percent
Content of rock fragments: 40 to 85 percent—10 to 50 percent stones and cobbles; 30 to 45 percent pebbles
Reaction: pH 5.6 to 7.3

93E—Libeg-Cheadle very channery loams, 15 to 45 percent slopes

Setting

Landform:
- Libeg—Mountains
- Cheadle—Mountains

Position on landform:
- Libeg—Backslopes and footslopes
- Cheadle—Backslopes and shoulders

Slope:
- Libeg—15 to 45 percent
- Cheadle—15 to 45 percent

Elevation: 5,500 to 7,800 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Libeg and similar soils: 60 percent
Cheadle and similar soils: 25 percent

Minor Components
Stemple and similar soils: 0 to 4 percent
Areas of rock outcrop: 0 to 4 percent
Areas with stony surface layers: 0 to 4 percent
Very shallow soils: 0 to 3 percent

Major Component Description

Libeg
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.6 inches

Cheadle
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

593E—Libeg-Cheadle-Rock outcrop complex, 15 to 45 percent slopes

Setting

Landform:
- Libeg—Mountains
- Cheadle—Mountains

Position on landform:
- Libeg—Backslopes and footslopes
- Cheadle—Backslopes and shoulders
- Rock outcrop—Backslopes and shoulders

Slope:
- Libeg—15 to 45 percent
- Cheadle—15 to 45 percent

Elevation: 5,500 to 7,800 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Libeg and similar soils: 40 percent
Cheadle and similar soils: 30 percent
Rock outcrop: 15 percent

Minor Components
Very shallow soils: 0 to 4 percent
Soils with stony surface layers: 0 to 4 percent
Soils on north aspects: 0 to 4 percent
Deep soils in drainageways: 0 to 3 percent

Major Component Description

Libeg
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.6 inches

Cheadle
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

Rock outcrop
Definition: Argillite and igneous bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Lihen Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Permeability: Rapid
Landform: Alluvial fans and hills
Parent material: Sandy alluvium or eolian deposits
Slope range: 2 to 35 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Sandy, mixed, frigid Entic Haplustolls

Typical Pedon

Lihen loamy fine sand, in an area of Lihen-Chinook complex, 2 to 35 percent slopes, in an area of rangeland, 300 feet south and 1,100 feet west of the northeast corner of sec. 17, T. 14 N., R. 3 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; neutral; clear smooth boundary.

A2—6 to 20 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium prismatic parting to weak medium subangular blocky structure; soft, very friable, slightly sticky, nonplastic; common very fine roots; neutral; gradual smooth boundary.

A3—20 to 30 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky,

nonplastic; common very fine roots; neutral; gradual smooth boundary.
C—30 to 60 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky, nonplastic; few very fine roots; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 12 to 30 inches

A horizons
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 5 to 10 percent
Content of rock fragments: 0 to 10 percent pebbles
Reaction: pH 6.1 to 8.4

C horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loamy fine sand, loamy sand, fine sand, or sand
Clay content: 0 to 10 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

556D—Lihen-Chinook complex, 2 to 35 percent slopes

Setting

Landform:
- Lihen—Hills
- Chinook—Hills

Slope:
- Lihen—2 to 35 percent
- Chinook—2 to 35 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Lihen and similar soils: 50 percent
Chinook and similar soils: 40 percent

Minor Components
Brocko and similar soils: 0 to 3 percent
Crago and similar soils: 0 to 3 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 1 percent
Soils with gravel at a depth of 40 inches: 0 to 1 percent

Major Component Description

Lihen
Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.7 inches

Chinook
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Marmarth Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Material derived from sandstone, siltstone, or shale
Slope range: 2 to 25 percent
Elevation range: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Marmarth loam, in an area of Marmarth-Delpoint loams, 2 to 8 percent slopes, in an area of rangeland,

300 feet north and 50 feet east of the southwest corner of sec. 36, T. 20 N., R. 4 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; neutral; clear smooth boundary.

Bt—3 to 9 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bk1—9 to 15 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; common fine and medium soft masses of lime; many faint lime coats on faces of peds; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—15 to 22 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 3 percent angular sandstone pebbles; many fine soft masses of lime; many faint lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—22 to 30 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 3 percent angular sandstone pebbles; disseminated lime; many faint lime coats on faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

Cr—30 to 60 inches; pale yellow (5Y 7/3) semiconsolidated sandstone; few very fine roots in cracks in upper part; strongly effervescent.

Range in Characteristics

Depth to the Cr horizon: 20 to 40 inches
Thickness of the mollic epipedon: 7 to 16 inches

A horizon
Value: 3 to 5 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Reaction: pH 6.1 to 7.3

Bt horizon
Hue: 10YR or 2.5Y
Value: 3 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent
Reaction: pH 6.1 to 7.8

Bk horizons
Hue: 2.5Y or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, fine sandy loam, or clay loam
Clay content: 15 to 30 percent
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.4 to 8.4

Cr horizon
Material: Soft sandstone or stratified soft sandstone and siltstone

382C—Marmarth-Delpoint loams, 2 to 8 percent slopes

Setting

Landform:
- Marmarth—Sedimentary plains
- Delpoint—Sedimentary plains

Slope:
- Marmarth—2 to 8 percent
- Delpoint—2 to 8 percent

Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Marmarth and similar soils: 45 percent
Delpoint and similar soils: 40 percent

Minor Components
Cabbart and similar soils: 0 to 4 percent
Amesha and similar soils: 0 to 4 percent
Shallow clayey soils: 0 to 4 percent
Moderately sodic soils: 0 to 3 percent

Major Component Description

Marmarth
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Meadowcreek Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderate to a depth of 35 inches and rapid below
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Fluvaquentic Haplustolls

Typical Pedon

Meadowcreek loam, in an area of Meadowcreek-Fairway complex, 0 to 2 percent slopes, in an area of cropland, 1,300 feet south and 2,000 feet east of the northwest corner of sec. 8, T. 10 N., R. 3 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

A1—5 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.

A2—10 to 15 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.

Bg1—15 to 27 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; few fine distinct brown (7.5YR 5/3) redox concentrations; weak coarse prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; neutral; gradual smooth boundary.

Bg2—27 to 35 inches; gray (10YR 6/1) sandy loam, dark grayish brown (10YR 4/2) moist; common fine distinct brown (7.5YR 5/4) redox concentrations; weak coarse prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; neutral; clear smooth boundary.

2Cg—35 to 60 inches; variegated colors, very gravelly sand; single grain; loose, nonsticky, nonplastic; few very fine roots; 55 percent pebbles; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 10 to 15 inches
Depth to the 2C horizon: 20 to 40 inches
Depth to the seasonal high water table: 24 to 42 inches

A horizons
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Clay content: 18 to 25 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

B horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 3 or 4 moist; 5 or 6 dry
Chroma: 1 to 3

Texture: Loam, sandy loam, sandy clay loam, or silt loam
Clay content: 18 to 25 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

2C horizon
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 50 to 75 percent—0 to 15 percent stones and cobbles; 50 to 70 percent pebbles
Reaction: pH 6.1 to 7.3

218A—Meadowcreek-Fairway complex, 0 to 2 percent slopes

Setting

Landform:
• Meadowcreek—Flood plains
• Fairway—Flood plains
Slope:
• Meadowcreek—0 to 2 percent
• Fairway—0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Meadowcreek and similar soils: 70 percent
Fairway and similar soils: 25 percent

Minor Components
Villy and similar soils: 0 to 2 percent
Well drained soils: 0 to 2 percent
Soils that are shallow to sand and gravel: 0 to 1 percent

Major Component Description

Meadowcreek
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 6.3 inches

Fairway
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 8.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Megonot Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills and sedimentary plains
Parent material: Semiconsolidated shale and mudstone
Slope range: 4 to 35 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, smectitic, frigid Torrertic Haplustepts

Typical Pedon

Megonot silty clay, in an area of Megonot-Weingart complex, 8 to 35 percent slopes, in an area of rangeland, 2,630 feet south and 800 feet west of the northeast corner of sec. 15, T. 20 N., R. 7 W.

A1—0 to 1 inch; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; slightly hard, firm, moderately sticky, moderately plastic; many very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.
A2—1 to 4 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky parting to weak very fine granular structure; hard, firm, moderately sticky, moderately plastic; many very fine roots; many very fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.
Bw—4 to 11 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist;

moderate medium prismatic parting to moderate medium angular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many shiny pressure faces on peds; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—11 to 23 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium angular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bky—23 to 30 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; weak fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; 50 percent angular and platy mudstone fragments; common fine seams of gypsum; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cr—30 to 60 inches; light olive gray (5Y 6/2) semiconsolidated mudstone, olive gray (5Y 4/2) moist; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to secondary lime: 11 to 27 inches
Depth to the paralithic contact: 20 to 40 inches

A horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent hard pebbles; 0 to 15 percent soft pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent hard pebbles; 0 to 15 percent soft pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bky horizon
Hue: 2.5Y or 5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 10 to 50 percent soft shale; 5 to 30 percent hard shale fragments
Gypsum content: 1 to 5 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 6.6 to 8.4

Cr horizon
Material: Semiconsolidated shale or mudstone

146C—Megonot silty clay, 4 to 8 percent slopes

Setting

Landform: Sedimentary plains
Slope: 4 to 8 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Megonot and similar soils: 95 percent

Minor Components
Soils that are shallow to shale: 0 to 2 percent
Deep silty clay soils: 0 to 2 percent
Moderately sodic soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Mudstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

149D—Megonot-Weingart complex, 8 to 35 percent slopes

Setting

Landform:
- Megonot—Hills
- Weingart—Hills

Position on landform:
- Megonot—Backslopes and shoulders
- Weingart—Footslopes

Slope:
- Megonot—8 to 35 percent
- Weingart—8 to 15 percent

Elevation: 3,600 to 4,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Megonot and similar soils: 45 percent
Weingart and similar soils: 40 percent

Minor Components
Areas of rock outcrop: 0 to 5 percent
Shallow silty clay soils: 0 to 5 percent
Soils that are gravelly: 0 to 5 percent

Major Component Description

Megonot
Surface layer texture: Silty clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Mudstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.7 inches

Weingart
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, clayey sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Mikesell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Mountains
Parent material: Alpine till or colluvium
Slope range: 8 to 60 percent
Elevation range: 4,600 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free season: 50 to 70 days

Taxonomic Class: Fine, smectitic Eutric Haplocryalfs

Typical Pedon

Mikesell stony loam, 8 to 35 percent slopes, in an area of woodland, 2,000 feet north and 2,000 feet west of the southeast corner of sec. 9, T. 13 N., R. 9 W.

Oi—2 inches to 0; forest litter of partially decomposed needles, twigs, and roots; abrupt smooth boundary.

A—0 to 4 inches; dark gray (10YR 4/1) stony loam, very dark gray (10YR 3/1) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, moderately sticky, slightly plastic; many very fine and fine roots; 5 percent stones, 5 percent cobbles; and 5 percent angular pebbles; moderately acid; clear smooth boundary.

E—4 to 9 inches; light brownish gray (10YR 6/2) cobbly loam, dark grayish brown (10YR 4/2) moist; moderate very thin platy parting to moderate very fine and fine granular structure; soft, very friable, moderately sticky, slightly plastic; many very fine and fine and few medium roots; many silt and sand skeletans on faces of peds; 10 percent cobbles and 5 percent angular pebbles; moderately acid; clear smooth boundary.

Bt/E—9 to 20 inches; 90 percent is pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist (B part); 10 percent is light gray (10YR 7/2) loam, brown (10YR 4/3) moist (E part); moderate medium prismatic parting to moderate medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; common silt and sand skeletans on faces of peds; 10 percent angular pebbles; moderately acid; clear smooth boundary.

Bt1—20 to 40 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate coarse subangular blocky structure; very hard, very firm, very sticky, and very plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct dark grayish brown (10YR 4/2) clay films on faces of peds and on coarse rock fragments; 5 percent angular cobbles and 5 percent angular pebbles; neutral; gradual smooth boundary.

Bt2—40 to 60 inches; pale brown (10YR 6/3) cobbly clay, brown (10YR 5/3) moist; moderate coarse subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine tubular and interstitial pores; many distinct clay films on faces of peds; 25 percent angular cobbles and 5 percent angular pebbles; neutral.

Range in Characteristics

Soil temperature: 35 to 40 degrees F

A and E horizons
Value: 4, 6, or 7 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 25 percent—1 to 5 percent stones; 0 to10 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 5.1 to 6.5

Bt horizons
Hue: 10YR or 2.5Y
Value: 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or clay loam
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 5.1 to 7.3

296F—Mikesell-Swiftcurrent loams, 25 to 60 percent slopes

Setting

Landform:
- Mikesell—Mountains
- Swiftcurrent—Mountains

Slope:
- Mikesell—25 to 60 percent
- Swiftcurrent—25 to 60 percent

Elevation: 4,800 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Mikesell and similar soils: 50 percent
Swiftcurrent and similar soils: 40 percent

Minor Components
Cowood and similar soils: 0 to 3 percent
Tigeron and similar soils: 0 to 3 percent
Soils that are deep to shale: 0 to 3 percent
Soils with stony surface layers: 0 to 1 percent

Major Component Description

Mikesell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 8.9 inches

Swiftcurrent
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

515E—Mikesell stony loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 5,000 to 5,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Mikesell and similar soils: 95 percent

Minor Components
Soils with more rock fragments: 0 to 2 percent
Soils that are shallow to soft bedrock: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 7.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Mocmont Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium derived from argillite and igneous rock
Slope range: 8 to 60 percent
Elevation range: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 70 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Mocmont very channery loam, in an area of Mocmont-Tolex complex, 25 to 60 percent slopes, in an area of woodland, 1,000 feet north and 1,500 feet west of the southeast corner of sec. 6, T. 13 N., R. 5 W.

Oi—2 inches to 0; forest litter of partially decomposed needles, twigs, and roots; abrupt smooth boundary.

E1—0 to 4 inches; light brownish gray (10YR 6/2) very channery loam, dark grayish brown (10YR 4/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; 45 percent channers; moderately acid; gradual smooth boundary.

E2—4 to 14 inches; light brownish gray (10YR 6/2) very channery loam, dark brown (10YR 4/3) moist; moderate thin platy parting to moderate very fine and fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine and fine and few medium roots; many very fine tubular and interstitial pores; 55 percent channers; moderately acid; gradual smooth boundary.

E/Bt—14 to 21 inches; 80 percent pinkish gray (7.5YR 6/2) extremely channery loam, dark brown (7.5YR 4/2) moist (E part); 20 percent light brown (7.5YR 6/4) dry; extremely channery clay loam, dark brown (10YR 4/3) moist (B part); moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; common faint clay films of faces of peds; 65 percent channers; moderately acid; gradual smooth boundary.

Bt/E—21 to 36 inches; 80 percent light brown (7.5YR 6/4) extremely channery clay loam, dark brown (10YR 4/3) moist (B part); 20 percent light gray (10YR 7/1) dry; extremely channery loam, dark brown (7.5YR 4/2) moist (E part); moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 65 percent channers; moderately acid; gradual smooth boundary.

Bt—36 to 60 inches; light brown (7.5YR 6/4) extremely channery clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium

subangular blocky structure; hard, friable, moderately sticky, moderately plastic; few very fine and fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; few silt and sand skeletans on faces of peds; 70 percent channers; moderately acid.

Range in Characteristics

Soil temperature: 42 to 45 degrees F
Depth to the argillic horizon: 10 to 24 inches

E horizons
Hue: 7.5YR or 10YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 15 to 20 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent angular cobbles; 35 to 50 percent angular pebbles or channers
Reaction: pH 5.6 to 6.5

E/Bt and Bt/E horizons
Hue: 7.5YR or 10YR
Value: E part—6 or 7 dry; 4 or 5 moist; B part—5 to 7 dry; 4 or 5 moist
Chroma: 1 to 4
Texture: E part—sandy loam or loam; B part—loam or clay loam
Clay content: E part—10 to 20 percent; B part—25 to 35 percent
Content of rock fragments: 35 to 60 percent—10 to 30 percent angular cobbles; 25 to 55 percent angular pebbles or channers
Reaction: pH 5.6 to 6.5

Bt horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 3, 4, or 6
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 85 percent—10 to 30 percent angular cobbles; 25 to 55 percent angular pebbles or channers
Reaction: pH 5.6 to 6.5

27F—Mocmont-Bignell-Tolex very stony loams, 25 to 60 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Bignell—Mountains
- Tolex—Mountains

Position on landform:
- Mocmont—Backslopes
- Bignell—Backslopes and footslopes
- Tolex—Backslopes and shoulders

Slope:
- Mocmont—25 to 60 percent
- Bignell—25 to 60 percent
- Tolex—25 to 60 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 105 days

Composition

Major Components
Mocmont and similar soils: 45 percent
Bignell and similar soils: 30 percent
Tolex and similar soils: 15 percent

Minor Components
Areas of rock outcrop: 0 to 3 percent
Soils with extremely stony surface layers: 0 to 3 percent
Areas of rubble land: 0 to 3 percent
Soils with less rock fragments: 0 to 1 percent

Major Component Description

Mocmont
Surface layer texture: Very stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.5 inches

Bignell
Surface layer texture: Very stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

Tolex
Surface layer texture: Very stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

63D—Mocmont-Tolex complex, 8 to 25 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Tolex—Mountains

Position on landform:
- Mocmont—Backslopes and footslopes
- Tolex—Backslopes and shoulders

Slope:
- Mocmont—8 to 25 percent
- Tolex—8 to 25 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 105 days

Composition

Major Components
Mocmont and similar soils: 75 percent
Tolex and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Soils that have slopes more than 25 percent: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

63F—Mocmont-Tolex complex, 25 to 60 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Tolex—Mountains

Position on landform:
- Mocmont—Backslopes
- Tolex—Backslopes and shoulders

Slope:
- Mocmont—25 to 60 percent
- Tolex—25 to 60 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Mocmont and similar soils: 70 percent
Tolex and similar soils: 20 percent

Minor Components
Holter and similar soils: 0 to 4 percent
Areas of rock outcrop: 0 to 3 percent
Moderately deep soils: 0 to 3 percent

Major Component Description

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained

Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

84E—Mocmont-Tolex complex, cool, 8 to 25 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Tolex—Mountains

Position on landform:
- Mocmont—Backslopes
- Tolex—Backslopes and shoulders

Slope:
- Mocmont—8 to 25 percent
- Tolex—8 to 25 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Mocmont and similar soils: 65 percent
Tolex and similar soils: 30 percent

Minor Components
Soils with less rock fragments: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

84F—Mocmont-Tolex complex, cool, 25 to 60 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Tolex—Mountains

Position on landform:
- Mocmont—Backslopes
- Tolex—Backslopes and shoulders

Slope:
- Mocmont—25 to 60 percent
- Tolex—25 to 60 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Mocmont and similar soils: 75 percent
Tolex and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Very shallow soils: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

184E—Mocmont very channery loam, cool, 15 to 35 percent slopes

Setting

Landform: Mountains
Slope: 15 to 35 percent
Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Mocmont and similar soils: 95 percent

Minor Components
Tolex and similar soils: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

384E—Mocmont-Tolex-Hilger very stony loams, 15 to 45 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Tolex—Mountains
- Hilger—Mountains

Position on landform:
- Mocmont—Backslopes and footslopes
- Tolex—Backslopes and shoulders
- Hilger—Backslopes and footslopes

Slope:
- Mocmont—15 to 45 percent
- Tolex—15 to 45 percent
- Hilger—15 to 45 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Mocmont and similar soils: 55 percent
Tolex and similar soils: 20 percent
Hilger and similar soils: 20 percent

Minor Components
Regent and similar soils: 0 to 2 percent
Soils that have slopes more than 45 percent: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 1 percent

Major Component Description

Mocmont
Surface layer texture: Very stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.5 inches

Tolex
Surface layer texture: Very stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

Hilger
Surface layer texture: Very stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

684F—Mocmont-Tolex complex, moist, 30 to 60 percent slopes

Setting

Landform:
- Mocmont—Mountains
- Tolex—Mountains

Position on landform:
- Mocmont—Backslopes
- Tolex—Backslopes and shoulders

Slope:
- Mocmont—30 to 60 percent
- Tolex—30 to 60 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Mocmont and similar soils: 75 percent
Tolex and similar soils: 20 percent

Minor Components
Holter and similar soils: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Musselshell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium from limestone
Slope range: 2 to 35 percent
Elevation range: 3,600 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free season: 105 to 120 days

Taxonomic Class: Coarse-loamy, carbonatic, frigid Aridic Calciustepts

Typical Pedon

Musselshell loam, in an area of Musselshell-Crago complex, 2 to 8 percent slopes, in an area of urban land, 100 feet south and 2,600 feet east of the northwest corner of sec. 28, T. 10 N., R. 3 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate very thin platy parting to weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 10 percent

pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—4 to 8 inches; light gray (10YR 7/2) gravelly loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 15 percent pebbles; few faint lime coats on faces of peds; continuous faint lime casts on undersides of pebbles; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—8 to 34 inches; white (10YR 8/2) gravelly loam, pale brown (10YR 6/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent pebbles; disseminated lime and common moderately thick lime coats on sides and undersides of pebbles; common fine and medium soft masses of lime; continuous faint lime coats on pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—34 to 50 inches; white (10YR 8/2) very gravelly sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; 50 percent pebbles; disseminated lime; continuous faint lime coats on pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Bkz—50 to 60 inches; very pale brown (10YR 8/3) very gravelly loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; 35 percent pebbles; few fine seams and soft masses of salt; disseminated lime; continuous faint lime coats on pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F

A horizon

Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 to 4
Clay content: 20 to 27 percent
Content of rock fragments: 0 to 10 percent stones; 0 to 25 percent cobbles; 0 to 35 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk horizons

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 10 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 9.0

Bkz horizon

Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Fine sandy loam, sandy loam, or loam
Clay content: 10 to 18 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 30 to 50 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 9.0

137B—Musselshell-Crago complex, 2 to 8 percent slopes

Setting

Landform:
- Musselshell—Alluvial fans
- Crago—Alluvial fans

Slope:
- Musselshell—2 to 8 percent
- Crago—2 to 8 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Musselshell and similar soils: 70 percent
Crago and similar soils: 25 percent

Minor Components
Amesha and similar soils: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 2 percent
Soils that are moderately deep to bedrock: 0 to 1 percent

Major Component Description

Musselshell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.6 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

341D—Musselshell-Crago-Pensore complex, 4 to 25 percent slopes

Setting

Landform:
- Musselshell—Alluvial fans
- Crago—Alluvial fans
- Pensore—Hills

Slope:
- Musselshell—4 to 25 percent
- Crago—4 to 25 percent
- Pensore—4 to 25 percent

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Musselshell and similar soils: 40 percent
Crago and similar soils: 25 percent
Pensore and similar soils: 20 percent

Minor Components
Amesha and similar soils: 0 to 4 percent
Soils that have slopes more than 25 percent: 0 to 4 percent
Areas of rock outcrop: 0 to 4 percent
Moderately deep soils: 0 to 3 percent

Major Component Description

Musselshell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.6 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

Pensore
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

437C—Musselshell-Sappington loams, 2 to 8 percent slopes

Setting

Landform:
- Musselshell—Alluvial fans
- Sappington—Alluvial fans

Slope:
- Musselshell—2 to 8 percent
- Sappington—2 to 8 percent

Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Musselshell and similar soils: 50 percent
Sappington and similar soils: 35 percent

Minor Components
Crago and similar soils: 0 to 7 percent
Soils that are shallow to bedrock: 0 to 4 percent
Soils with gravelly loam surface layers: 0 to 4 percent

Major Component Description

Musselshell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.6 inches

Sappington
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Neen Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,600 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free season: 105 to 120 days

Taxonomic Class: Fine-silty, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Neen silt loam, 0 to 2 percent slopes, in an area of pasture; 200 feet north and 900 feet west of the southeast corner of sec. 16, T. 11 N., R. 3 W.

Apz—0 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure with $^1/_8$- to $^1/_4$-inch crust at surface; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; common fine seams and masses of salts; disseminated lime; strongly effervescent; strongly alkaline; clear smooth boundary.

Bwz1—8 to 22 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; common fine seams of salts; disseminated lime; violently effervescent; strongly alkaline; clear smooth boundary.

Bwz2—22 to 33 inches; very pale brown (10YR 8/3) silt loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, moderately sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; few fine seams and masses of salts; disseminated lime; few soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bwz3—33 to 39 inches; very pale brown (10YR 8/3) silty clay loam, light yellowish brown (10YR 6/4) moist; common medium prominent strong brown (7.5YR 5/6) redox concentrations; massive; hard, friable, moderately sticky, moderately plastic; disseminated lime; common soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg1—39 to 48 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/2) moist; common medium prominent strong brown (7.5YR 5/6) redox concentrations; massive; hard, friable, moderately sticky, moderately plastic; disseminated lime; common soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg2—48 to 60 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; common medium distinct strong brown (7.5YR 5/6) redox concentrations and gray (10YR 6/1) redox depletions; massive; hard, very friable, moderately sticky, slightly plastic; 5 percent

pebbles; disseminated lime; common large soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Range in Characteristics

Soil temperature: 40 to 44 degrees F
Depth to the seasonal high water table: 24 to 42 inches

Apz horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 2 to 4 moist
Chroma: 1 or 2
Clay content: 20 to 27 percent
Sodium adsorption ratio: 13 to 30
Electrical conductivity: 8 to 16 mmhos/cm
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 9.0

Bwz horizons
Hue: 2.5Y or 5Y
Value: 7 or 8 dry; 5 to 7 moist
Chroma: 1 to 4
Redox concentrations: None to common; 7.5YR 5/6, 5YR 4/6, or 5YR 5/8
Texture: Silty clay loam or silt loam
Clay content: 20 to 35 percent
Calcium carbonate equivalent: 20 to 40 percent
Sodium adsorption ratio: 13 to 30
Electrical conductivity: 2 to 16 mmhos/cm
Reaction: pH 7.4 to 9.0

Bkg horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 6 to 8 dry; 3 to 6 moist
Chroma: 1 to 3
Redox depletions and concentrations: Few to many; 10YR 6/1, 7.5YR 5/6, 5YR 4/6, or 5YR 5/8
Texture: Silty clay loam, clay loam, loam, or silt loam
Clay content: 20 to 35 percent
Sodium adsorption ratio: 13 to 30
Electrical conductivity: 8 to 16 mmhos/cm
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 9.0

115A—Neen silt loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Neen and similar soils: 95 percent

Minor Components
Villy and similar soils: 0 to 3 percent
Very deep saline and sodic soils: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 7.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Niart Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 3 percent
Elevation range: 3,800 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, carbonatic, frigid Aridic Calciustolls

Typical Pedon

Niart loam, 0 to 3 percent slopes, in an area of rangeland, 300 feet north and 2,500 feet east of the southwest corner of sec. 16, T. 20 N., R. 4 W.

A—0 to 5 inches; dark grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist;

moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent cobbles and 5 percent pebbles; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—5 to 8 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous faint thin lime casts on undersides of pebbles; disseminated lime; few soft masses of lime; continuous distinct lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—8 to 27 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous faint lime casts on undersides of pebbles; common fine and medium soft masses of lime; continuous distinct lime coats on faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk3—27 to 60 inches; light gray (10YR 7/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots in upper part; 65 percent pebbles; continuous faint lime casts on undersides of pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the 2Bk horizon: 19 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Content of rock fragments: 5 to 15 percent—0 to 5 percent cobbles; 5 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 25 to 35 percent (20 to 30 percent noncarbonate clay)
Content of rock fragments: 5 to 30 percent—0 to 5 percent cobbles; 5 to 25 percent pebbles
Calcium carbonate equivalent: 40 to 55 percent
Reaction: pH 7.9 to 8.4

2Bk3 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Loam, sandy clay loam, or sandy loam
Clay content: 20 to 30 percent (10 to 25 percent noncarbonate clay)
Content of rock fragments: 35 to 80 percent—5 to 10 percent cobbles; 30 to 70 percent pebbles
Calcium carbonate equivalent: 40 to 55 percent
Reaction: pH 7.9 to 8.4

43A—Niart loam, 0 to 3 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 3 percent
Elevation: 3,800 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Niart and similar soils: 95 percent

Minor Components
Sappington and similar soils: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 2 percent
Soils with sand and gravel at 30 inches: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Nippt Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 15 inches and rapid below
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Haplustalfs

Typical Pedon

Nippt gravelly loam, in an area of Nippt-Geohrock gravelly loams, 2 to 4 percent slopes, in an area of rangeland, 2,300 feet north and 1,600 feet east of the southwest corner of sec. 25, T. 12 N., R. 5 W.

E—0 to 3 inches; light brownish gray (10YR 6/2) gravelly loam, dark brown (10YR 4/3) moist; moderate very thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine vesicular pores; 15 percent pebbles; slightly alkaline; clear smooth boundary.

Bt—3 to 9 inches; brown (10YR 5/3) gravelly clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; many very fine tubular and interstitial pores; many distinct dark brown (10YR 3/3) moist clay films on faces of peds; 25 percent pebbles; slightly alkaline; clear smooth boundary.

Bk1—9 to 15 inches; light gray (10YR 7/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; continuous distinct lime casts on undersides of pebbles; 60 percent pebbles; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk2—15 to 60 inches; light gray (10YR 7/2) extremely gravelly sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky, nonplastic; common very fine and fine roots; continuous faint lime casts on undersides of pebbles; 65 percent pebbles; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 5 to 10 inches
Depth to the 2Bk2 horizon: 10 to 20 inches

E horizon
Hue: 10YR or 7.5YR
Value: 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles; 5 to 30 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 10YR to 7.5YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 3 or 4
Clay content: 27 to 35 percent
Content of rock fragments: 20 to 60 percent—0 to 20 percent cobbles; 15 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

Bk1 horizon
Hue: 10YR or 7.5YR
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 5 to 15 percent
Content of rock fragments: 50 to 70 percent—0 to 25 percent cobbles; 35 to 60 percent pebbles
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.9 to 8.4

2Bk2 horizon
Hue: 10YR or 7.5YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 0 to 5 percent
Content of rock fragments: 60 to 80 percent—0 to 30 percent cobbles; 40 to 70 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

206A—Nippt very cobbly loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,600 to 4,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Nippt and similar soils: 95 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 3 percent
Soils with loam surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

232B—Nippt-Geohrock gravelly loams, 2 to 4 percent slopes

Setting

Landform:
- Nippt—Stream terraces
- Geohrock—Stream terraces

Slope:
- Nippt—2 to 4 percent
- Geohrock—2 to 4 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Nippt and similar soils: 50 percent
Geohrock and similar soils: 45 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 3 percent
Soils with no rock fragments: 0 to 2 percent

Major Component Description

Nippt
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

Geohrock
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

306A—Nippt-Attewan-Beaverell complex, 0 to 4 percent slopes

Setting

Landform:
- Nippt—Stream terraces
- Attewan—Stream terraces
- Beaverell—Stream terraces

Slope:
- Nippt—0 to 4 percent
- Attewan—0 to 4 percent
- Beaverell—0 to 4 percent

Elevation: 3,600 to 4,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Nippt and similar soils: 55 percent
Attewan and similar soils: 20 percent
Beaverell and similar soils: 15 percent

Minor Components
Soils with cobbly loam surface layers: 0 to 4 percent
Soils with very gravelly loam surfaces: 0 to 3 percent
Soils that are calcareous throughout: 0 to 3 percent

Major Component Description

Nippt
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

Attewan
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Beaverell
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

406A—Nippt gravelly loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Nippt and similar soils: 95 percent

Minor Components
Scravo and similar soils: 0 to 2 percent
Thess and similar soils: 0 to 2 percent
Soils that have slopes more than 2 percent: 0 to 1 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

506A—Nippt-Attewan complex, 0 to 2 percent slopes

Setting

Landform:
- Nippt—Stream terraces
- Attewan—Stream terraces

Slope:
- Nippt—0 to 2 percent
- Attewan—0 to 2 percent

Elevation: 3,600 to 4,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Nippt and similar soils: 70 percent
Attewan and similar soils: 25 percent

Minor Components
Soils with very cobbly loam surfaces: 0 to 5 percent

Major Component Description

Nippt
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.0 inches

Attewan
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Nobe Series

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, smectitic, calcareous, frigid Torrertic Ustorthents

Typical Pedon

Nobe clay loam, in an area of Gerdrum-Nobe-Yamacall complex, 0 to 4 percent slopes, in an area of rangeland, 1,500 feet south and 2,000 feet east of the northwest corner of sec. 36, T. 20 N., R. 4 W.

E—0 to 1 inch; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; moderate very thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine vesicular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bt—1 to 3 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic parting to moderate medium angular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; strongly effervescent; strongly alkaline; clear smooth boundary.

Byz1—3 to 30 inches; light brownish gray (10YR 6/2) silty clay, brown (10YR 5/3) moist; massive; hard, firm, moderately sticky, moderately plastic; common very fine roots; common fine seams and masses of gypsum and other salts; strongly effervescent; strongly alkaline; gradual smooth boundary.

Byz2—30 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 4/2) moist; common fine distinct olive gray (5Y 5/2) redox depletions; massive; hard, firm, moderately sticky, moderately plastic; 5 percent pebbles; common fine seams and masses of gypsum and other salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the saturated zone: 24 to 42 inches for 1 to 4 months in the spring. The soil is moist below 42 inches when not saturated or frozen.
Other features: In some areas, the Bt horizon is recognized as having characteristics of an argillic horizon but does not meet the minimum thickness requirements.

E horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam (clay loam when mixed to 7 inches)
Clay content: 20 to 27 percent
Electrical conductivity: 4 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 13
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bt horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 27 to 40 percent

Electrical conductivity: 4 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 30
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

Byz1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 60 percent
Electrical conductivity: 16 to 30 mmhos/cm
Gypsum content: 1 to 6 percent
Sodium adsorption ratio: 13 to 40
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.6

Byz2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Textures: Clay, silty clay, or silty clay loam that is stratified with loam, clay loam, or silt loam
Clay content: 35 to 60 percent
Electrical conductivity: 16 to 30 mmhos/cm
Gypsum content: 1 to 6
Sodium adsorption ratio: 13 to 70
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.6

Owen Creek Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Mountains
Parent material: Material derived from shale
Slope range: 15 to 45 percent
Elevation range: 4,800 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Fine, smectitic Ustic Argicryolls

Typical Pedon

Owen Creek loam, 15 to 45 percent slopes, in an area of rangeland, 400 feet south and 2,500 feet east of the northwest corner of sec. 31, T. 19 N., R. 7 W.

A1—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and few medium roots; slightly acid; clear smooth boundary.

A2—6 to 14 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; slightly acid; clear smooth boundary.

Bt1—14 to 16 inches; gray (10YR 5/1) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; common light gray (10YR 7/2) dry; silt and sand skeletans on faces of peds in upper part; 5 percent angular pebbles; slightly acid; clear smooth boundary.

Bt2—16 to 26 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct very dark grayish brown (2.5Y 3/2) moist; clay films on faces of peds; neutral; gradual smooth boundary.

Btk—26 to 37 inches; grayish brown (2.5Y 5/2) silty clay, olive gray (5Y 4/2) moist; moderate medium prismatic structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; common very fine tubular and interstitial pores; common distinct dark olive gray (5Y 3/2) clay films on faces of peds; few fine soft masses and seams of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cr—37 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated shale that crushes to silty clay loam, dark grayish brown (2.5Y 4/2) moist; common faint lime coats on undersides of shale fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 35 to 40 degrees F
Depth to secondary lime: 15 to 34 inches
Depth to the paralithic contact: 20 to 40 inches

A horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent hard pebbles; 0 to 15 percent soft pebbles
Reaction: pH 6.6 to 8.4

Btk horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent hard pebbles; 0 to 15 percent soft pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

680E—Owen Creek-Cheadle complex, 15 to 45 percent slopes

Setting

Landform:
- Owen Creek—Mountains
- Cheadle—Mountains

Position on landform:
- Owen Creek—Backslopes
- Cheadle—Shoulders

Slope:
- Owen Creek—15 to 45 percent
- Cheadle—15 to 45 percent

Elevation: 4,800 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Owen Creek and similar soils: 75 percent
Cheadle and similar soils: 15 percent

Minor Components
Soils that have slopes more than 45 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 2 percent
Soils with stony loam surface layers: 0 to 2 percent
Soils with darker colored surface layers: 0 to 1 percent
Soils with hard bedrock at 30 inches: 0 to 1 percent

Major Component Description

Owen Creek
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.3 inches

Cheadle
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

880E—Owen Creek loam, 15 to 45 percent slopes

Setting

Landform: Mountains
Slope: 15 to 45 percent
Elevation: 4,800 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Owen Creek and similar soils: 90 percent

Minor Components
Cheadle and similar soils: 0 to 2 percent
Leavitt and similar soils: 0 to 2 percent
Soils that have slopes more than 45 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 1 percent
Soils with stony loam surface layers: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

980E—Owen Creek-Bridger stony loams, 15 to 35 percent slopes

Setting

Landform:
• Owen Creek—Mountains
• Bridger—Mountains
Slope:
• Owen Creek—15 to 35 percent
• Bridger—15 to 35 percent
Elevation: 4,800 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Owen Creek and similar soils: 55 percent
Bridger and similar soils: 35 percent

Minor Components
Cheadle and similar soils: 0 to 2 percent
Libeg and similar soils: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils with gravelly loam surface layers: 0 to 2 percent

Major Component Description

Owen Creek
Surface layer texture: Stony loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Bridger
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Peeler Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Material derived from granitic rock
Slope range: 15 to 60 percent
Elevation range: 5,000 to 6,000 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Ustic Glossocryalfs

Typical Pedon

Peeler very bouldery sandy loam, in an area of Peeler-Rock outcrop complex, 15 to 60 percent slopes, in an area of forestland, 900 feet south and 2,400 feet west of the northeast corner of sec. 21, T. 9 N., R. 4 W.

Oi—4 inches to 0; forest litter of partially decomposed needles and twigs; abrupt smooth boundary.

E—0 to 20 inches; light brownish gray (10YR 6/2) very bouldery sandy loam, dark grayish brown (10YR 4/2) moist; weak thin platy parting to weak fine and medium granular structure; soft, very friable, slightly sticky, nonplastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; slightly acid; clear smooth boundary.

E/Bt—20 to 23 inches; 80 percent pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist

(E part); 20 percent yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist (B part); moderate medium prismatic structure; slightly hard, friable, slightly sticky, nonplastic; common very fine and fine roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds and bridging sand grains; 10 percent angular cobbles; neutral; gradual smooth boundary.

Bt/E—23 to 45 inches; 90 percent light yellowish brown (10YR 6/4) cobbly sandy clay loam, dark yellowish brown (10YR 4/4) moist (B part); 10 percent pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist (E part); moderate medium prismatic structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds and bridging sand grains; few discontinuous brown (7.5YR 5/4) layers of clay accumulations 1/4-inch thick; 5 percent stones and 25 percent cobbles; neutral; gradual smooth boundary.

Bt—45 to 52 inches; pale brown (10YR 6/3) cobbly sandy clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, nonplastic; few very fine and fine roots; common very fine tubular and interstitial pores; common distinct yellowish brown (10YR 5/4) clay films on faces of peds and bridging sand grains; few discontinuous dark yellowish brown (10YR 3/4) moist, layers of clay accumulations 1/4-inch thick; 20 percent angular cobbles; neutral; gradual smooth boundary.

C—52 to 60 inches; grayish brown (2.5Y 5/2) cobbly sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose and nonsticky; few very fine and fine roots; 20 percent angular cobbles; neutral.

Range in Characteristics

Soil temperature: 36 to 42 degrees F

E horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 3 to 7 moist
Chroma: 1 to 4 or 6
Clay content: 5 to 15 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 5.6 to 6.5

E/Bt and Bt/E horizons
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 3 to 7 moist
Chroma: 1 to 4 or 6
Clay content: 18 to 30 percent
Reaction: pH 5.6 to 7.3

Bt horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4 or 6
Clay content: 18 to 30 percent
Reaction: pH 5.6 to 7.3

C horizon
Hue: 2.5Y or 5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 0 to 10 percent
Gypsum content: 1 to 5 percent
Reaction: pH 5.6 to 7.3

386E—Peeler stony sandy loam, 15 to 45 percent slopes

Setting

Landform: Mountains
Slope: 15 to 45 percent
Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Peeler and similar soils: 95 percent

Minor Components
Soils with more rock fragments: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Surface layer texture: Stony sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from granitic rocks
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 6.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

486F—Peeler-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform: Mountains
Position on landform:
- Peeler—Backslopes
- Rock outcrop—Backslopes and shoulders

Slope: 15 to 60 percent
Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Peeler and similar soils: 80 percent
Rock outcrop: 10 percent

Minor Components
Moderately deep soils: 0 to 4 percent
Poorly drained soils: 0 to 2 percent
Areas of rubble land: 0 to 2 percent
Soils with stony sandy loam surfaces: 0 to 2 percent

Major Component Description

Peeler
Surface layer texture: Very bouldery sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from granitic rocks
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 6.6 inches

Rock outcrop
Definition: Hard granite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Pensore Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountains
Parent material: Material derived from limestone
Slope range: 4 to 60 percent
Elevation range: 3,800 to 5,500 feet
Mean annual precipitation: 10 to 15 inches
Frost-free period: 90 to 120 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Lithic Calciustepts

Typical Pedon

Pensore gravelly loam, in an area of Pensore-Rock outcrop complex, 15 to 60 percent slopes, in an area of rangeland, 400 feet south and 500 feet east of the northwest corner of sec. 30, T. 10 N., R. 4 W.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 20 percent angular pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—4 to 15 inches; light gray (10YR 7/2) very gravelly loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent angular cobbles and 45 percent angular pebbles; disseminated lime; continuous faint lime coats on coarse rock fragments; continuous thick lime casts on undersides of coarse rock fragments; violently effervescent; moderately alkaline.

R—15 inches; hard limestone bedrock with few fractures; few very fine roots in fractures.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to bedrock: 10 to 20 inches
Depth to the Bk horizon: 3 to 7 inches
Other features: When mixed to 7 inches, the A horizon will not meet the requirements for a mollic epipedon.

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 1 to 3
Clay content: 10 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent stones and cobbles; 15 to 50 percent pebbles or channers
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

Bk horizon
- Hue: 10YR or 2.5Y
- Value: 7 or 8 dry; 6 or 7 moist
- Chroma: 2 to 4
- Clay content: 10 to 25 percent
- Content of rock fragments: 35 to 60 percent—0 to 15 percent stones and cobbles; 35 to 55 percent pebbles or channers
- Calcium carbonate equivalent: 40 to 60 percent, including coarse rock fragments less than 3/4-inch in size
- Reaction: pH 7.9 to 8.4

241F—Pensore-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform: Hills
Position on landform:
- Pensore—Backslopes
- Rock outcrop—Backslopes and shoulders

Slope: 15 to 60 percent
Elevation: 3,800 to 5,500 feet
Mean annual precipitation: 10 to 15 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Pensore and similar soils: 65 percent
Rock outcrop: 25 percent

Minor Components
Crago and similar soils: 0 to 4 percent
Very shallow soils: 0 to 3 percent
Moderately deep soils: 0 to 3 percent

Major Component Description

Pensore
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Rock outcrop
Definition: Hard limestone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Perma Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate or moderate over rapid
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 2 to 15 percent
Elevation range: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Haplustolls

Typical Pedon

Perma gravelly loam, 2 to 15 percent slopes, in an area of cropland, 1,100 feet north and 2,450 feet west of the southeast corner of sec. 24, T. 12 N., R. 7 W.

Ap—0 to 6 inches, dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 15 percent angular pebbles; neutral; clear smooth boundary.

A2—6 to 10 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; many worm casts; 20 percent angular pebbles; neutral; clear smooth boundary.

A3—10 to 15 inches; dark brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 50 percent angular pebbles; neutral; clear smooth boundary.

Bw1—15 to 38 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 65 percent angular pebbles; neutral; gradual smooth boundary.

Bw2—38 to 60 inches; light brown (7.5YR 6/4) extremely gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; 70 percent angular pebbles; neutral.

Range in Characteristics

Soil temperature: 44 to 47 degrees F
Thickness of the mollic epipedon: 10 to 15 inches

A horizons
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 7 to 20 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent boulders, stones, and cobbles; 15 to 30 percent pebbles
Reaction: pH 6.6 to 7.3

Bw horizons
Hue: 10YR or 7.5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 7 to 15 percent
Content of rock fragments: 35 to 85 percent—0 to 50 percent stones and cobbles; 25 to 65 percent pebbles
Reaction: pH 6.6 to 7.8

188C—Perma gravelly loam, 2 to 15 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 15 percent
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Perma and similar soils: 95 percent

Minor Components
Shawmut and similar soils: 0 to 3 percent
Soils that have slopes more than 15 percent: 0 to 2 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

500—Pits, gravel

Setting

Landform: Stream terraces
Elevation: 3,500 to 5,000 feet
Mean annual precipitation: 10 to 19 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Pits, gravel: 90 percent

Minor Components
Soils with loam textures: 0 to 10 percent

Major Component Description

Definition: An area mined as a source of sand and gravel
Dominant parent material: Alluvium

Reeder Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Material derived from semiconsolidated sandstone, mudstone, or siltstone
Slope range: 2 to 30 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Reeder loam, in an area of Reeder-Regent-Cabba loams, 8 to 25 percent slopes, in an area of

rangeland, 140 feet north and 150 feet west of the southeast corner of sec. 4, T. 18 N., R. 4 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; slightly alkaline; clear smooth boundary.
Bt—4 to 9 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; slightly alkaline; gradual smooth boundary.
Btk—9 to 16 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct dark brown (10YR 4/3) clay films on faces of peds; common fine seams and soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk1—16 to 22 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent flat soft sandstone fragments; continuous distinct lime casts on undersides of rock fragments; many fine seams and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
Bk2—22 to 28 inches; pale yellow (2.5Y 7/4) silt loam, olive brown (2.5Y 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 50 percent flat soft sandstone fragments; continuous distinct lime casts on undersides of rock fragments; many fine seams and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
Cr—28 to 60 inches; pale yellow (5Y 7/3) semiconsolidated sandstone, olive (5Y 4/4) moist; strongly effervescent.

Range in Characteristics

Soil temperature: 44 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Cr horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Loam, sandy clay loam, or clay loam
Clay content: 18 to 35 percent
Reaction: pH 6.6 to 7.8

Btk and Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, silt loam, silty clay loam, clay loam, or sandy clay loam
Clay content: 15 to 30 percent
Calcium carbonate equivalent: 15 to 20 percent
Reaction: pH 7.4 to 8.4

Cr horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 3 to 5 moist

280D—Reeder-Regent-Castner complex, 8 to 25 percent slopes

Setting

Landform:
- Reeder—Hills
- Regent—Hills
- Castner—Hills

Position on landform:
- Reeder—Backslopes and footslopes
- Regent—Backslopes and footslopes
- Castner—Shoulders

Slope:
- Reeder—8 to 25 percent
- Regent—8 to 25 percent
- Castner—8 to 25 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Reeder and similar soils: 50 percent
Regent and similar soils: 25 percent
Castner and similar soils: 15 percent

Minor Components

Soils that have slopes more than 25 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils with hard bedrock at 5 to 10 inches: 0 to 2 percent
Shallow loam textured soils: 0 to 2 percent
Shallow clayey textured soils: 0 to 1 percent
Moderately sodic soils: 0 to 1 percent

Major Component Description

Reeder

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Regent

Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Castner

Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

380C—Reeder-Regent-Cabba loams, 2 to 8 percent slopes

Setting

Landform:
- Reeder—Sedimentary plains
- Regent—Sedimentary plains
- Cabba—Sedimentary plains

Position on landform:
- Reeder—Backslopes and footslopes
- Regent—Backslopes and footslopes
- Cabba—Shoulders

Slope:
- Reeder—2 to 8 percent
- Regent—2 to 8 percent
- Cabba—2 to 8 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Reeder and similar soils: 45 percent
Regent and similar soils: 30 percent
Cabba and similar soils: 15 percent

Minor Components

Castner and similar soils: 0 to 2 percent
Poorly drained saline soils: 0 to 2 percent
Farnuf and similar soils: 0 to 2 percent
Shallow clayey soils: 0 to 2 percent
Soils that are moderately saline and sodic: 0 to 1 percent
Soils with silt loam surface layers: 0 to 1 percent

Major Component Description

Reeder

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Regent
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

380D—Reeder-Regent-Cabba loams, 8 to 25 percent slopes

Setting

Landform:
- Reeder—Hills
- Regent—Hills
- Cabba—Hills

Position on landform:
- Reeder—Backslopes and footslopes
- Regent—Backslopes and footslopes
- Cabba—Shoulders

Slope:
- Reeder—8 to 25 percent
- Regent—8 to 25 percent
- Cabba—8 to 25 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Reeder and similar soils: 45 percent
Regent and similar soils: 30 percent
Cabba and similar soils: 15 percent

Minor Components
Castner and similar soils: 0 to 3 percent
Areas of rock outcrop: 0 to 3 percent
Soils with silt loam surface layers: 0 to 2 percent
Shallow clayey soils: 0 to 2 percent

Major Component Description

Reeder
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Regent
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

480D—Reeder-Castner complex, 4 to 25 percent slopes

Setting

Landform:
- Reeder—Hills
- Castner—Hills

Position on landform:
• Reeder—Backslopes
• Castner—Shoulders
Slope:
• Reeder—4 to 25 percent
• Castner—4 to 25 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Reeder and similar soils: 65 percent
Castner and similar soils: 25 percent

Minor Components
Regent and similar soils: 0 to 3 percent
Farnuf and similar soils: 0 to 3 percent
Areas of rock outcrop: 0 to 2 percent
Very shallow soils: 0 to 2 percent

Major Component Description

Reeder
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

580E—Reeder-Castner-Rock outcrop complex, 8 to 45 percent slopes

Setting

Landform:
• Reeder—Hills
• Castner—Hills
Position on landform:
• Reeder—Backslopes
• Castner—Shoulders
• Rock outcrop—Shoulders
Slope:
• Reeder—8 to 25 percent
• Castner—8 to 45 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Reeder and similar soils: 60 percent
Castner and similar soils: 20 percent
Rock outcrop: 10 percent

Minor Components
Regent and similar soils: 0 to 3 percent
Very shallow soils: 0 to 3 percent
Shallow clayey soils: 0 to 2 percent
Shallow loam textured soils: 0 to 2 percent

Major Component Description

Reeder
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Rock outcrop
Definition: Hard sandstone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Regent Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills and sedimentary plains
Parent material: Material derived from semiconsolidated shale and mudstone
Slope range: 2 to 35 percent
Elevation range: 3,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, smectitic, frigid Vertic Argiustolls

Typical Pedon

Regent loam, in an area of Reeder-Regent-Cabba loams, 8 to 25 percent slopes, in an area of rangeland, 100 feet north and 200 feet west of the southeast corner of sec. 26, T. 18 N., R. 5 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; slightly acid; clear smooth boundary.

Bt—4 to 10 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; strong medium prismatic structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous distinct very dark grayish brown (10YR 3/2) moist clay films on faces of peds; neutral; gradual smooth boundary.

Btk—10 to 20 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium prismatic parting to moderate medium angular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 5 percent pebbles; continuous faint lime coats on undersides of pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—20 to 30 inches; light olive gray (5Y 6/2) silty clay, olive (5Y 4/3) moist; massive; hard, firm, moderately sticky, moderately plastic; few very fine roots; 20 percent flat and angular shale chips; disseminated lime; continuous distinct lime coats on pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cr—30 to 60 inches; light olive gray (5Y 6/2) semiconsolidated shale and mudstone, olive gray (5Y 5/2) moist; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Cr horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 40 percent
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 2 to 5 moist
Chroma: 2 to 4
Texture: Silty clay loam, clay, or silty clay
Clay content: 35 to 50 percent
Reaction: pH 7.4 to 9.0

Btk and Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silty clay loam, clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

Cr horizon
Material: Semiconsolidated shale and mudstone

80C—Regent clay loam, 2 to 10 percent slopes

Setting

Landform: Hills
Slope: 2 to 10 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 95 percent

Minor Components
Reeder and similar soils: 0 to 2 percent
Shallow clayey soils: 0 to 2 percent
Saline and sodic soils: 0 to 1 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

178D—Regent-Reeder-Work stony loams, 4 to 30 percent slopes

Setting

Landform:
- Regent—Hills
- Reeder—Hills
- Work—Hills

Slope:
- Regent—4 to 30 percent
- Reeder—4 to 30 percent
- Work—4 to 30 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 40 percent
Reeder and similar soils: 30 percent
Work and similar soils: 20 percent

Minor Components
Farnuf and similar soils: 0 to 5 percent
Shallow loamy soils: 0 to 5 percent

Major Component Description

Regent
Surface layer texture: Stony loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Reeder
Surface layer texture: Stony loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Work
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

180D—Regent-Castner complex, 8 to 35 percent slopes

Setting

Landform:
- Regent—Hills
- Castner—Hills

Position on landform:
- Regent—Backslopes and footslopes
- Castner—Shoulders

Slope:
- Regent—8 to 25 percent
- Castner—8 to 35 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 65 percent
Castner and similar soils: 20 percent

Minor Components
Reeder and similar soils: 0 to 3 percent
Hilger and similar soils: 0 to 3 percent
Shallow clayey soils: 0 to 3 percent
Soils that have slopes more than 35 percent: 0 to 3 percent
Areas of rock outcrop: 0 to 2 percent
Shallow loamy soils: 0 to 1 percent

Major Component Description

Regent
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

278C—Regent-Auchard loams, 2 to 8 percent slopes

Setting

Landform:
- Regent—Sedimentary plains
- Auchard—Sedimentary plains

Slope:
- Regent—2 to 8 percent
- Auchard—2 to 8 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 65 percent
Auchard and similar soils: 25 percent

Minor Components
Shallow soils: 0 to 3 percent
Poorly drained saline soils: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 2 percent
Deep loamy soils: 0 to 2 percent

Major Component Description

Regent
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Auchard
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, clayey sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

479E—Regent-Wayden-Cabba complex, 15 to 45 percent slopes

Setting

Landform:
- Regent—Hills
- Wayden—Hills
- Cabba—Hills

Position on landform:
- Regent—Backslopes and footslopes
- Wayden—Backslopes and shoulders
- Cabba—Backslopes and shoulders

Slope:
- Regent—15 to 35 percent
- Wayden—15 to 45 percent
- Cabba—15 to 45 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 45 percent
Wayden and similar soils: 30 percent
Cabba and similar soils: 20 percent

Minor Components
Farnuf and similar soils: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils that have slopes more than 45 percent: 0 to 1 percent

Major Component Description

Regent
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Wayden
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

743D—Regent-Fairfield-Winspect stony loams, 8 to 35 percent slopes

Setting

Landform:
- Regent—Hills
- Fairfield—Moraines
- Winspect—Moraines

Position on landform:
- Regent—Backslopes and shoulders
- Fairfield—Footslopes
- Winspect—Backslopes and shoulders

Slope:
- Regent—8 to 25 percent
- Fairfield—8 to 25 percent
- Winspect—8 to 35 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 40 percent
Fairfield and similar soils: 30 percent
Winspect and similar soils: 20 percent

Minor Components

Soils that have slopes more than 35 percent: 0 to 3 percent
Soils shallow to bedrock: 0 to 3 percent
Areas of rock outcrop: 0 to 2 percent
Soils with gravelly loam surface layers: 0 to 2 percent

Major Component Description

Regent

Surface layer texture: Stony loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Fairfield

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.1 inches

Winspect

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

780E—Regent-Sinnigam complex, 8 to 35 percent slopes

Setting

Landform:
- Regent—Hills
- Sinnigam—Hills

Position on landform:
- Regent—Backslopes and footslopes
- Sinnigam—Shoulders

Slope:
- Regent—8 to 25 percent
- Sinnigam—8 to 35 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Regent and similar soils: 60 percent
Sinnigam and similar soils: 30 percent

Minor Components

Work and similar soils: 0 to 2 percent
Reeder and similar soils: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Moderately sodic soils: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent

Major Component Description

Regent

Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Sinnigam

Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Interbedded sandstone and shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

879E—Regent-Wayden complex, 8 to 35 percent slopes

Setting

Landform:
- Regent—Hills
- Wayden—Hills

Position on landform:
- Regent—Backslopes and footslopes
- Wayden—Shoulders

Slope:
- Regent—8 to 25 percent
- Wayden—8 to 35 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 65 percent
Wayden and similar soils: 30 percent

Minor Components
Farnuf and similar soils: 0 to 2 percent
Areas of rock outcrop: 0 to 1 percent
Soils that have slopes more than 35 percent: 0 to 1 percent
Shallow loamy soils: 0 to 1 percent

Major Component Description

Regent
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Wayden
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

979E—Regent-Lap complex, 8 to 45 percent slopes

Setting

Landform:
- Regent—Hills
- Lap—Hills

Position on landform:
- Regent—Backslopes
- Lap—Shoulders

Slope:
- Regent—8 to 45 percent
- Lap—8 to 45 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Regent and similar soils: 65 percent
Lap and similar soils: 20 percent

Minor Components
Reeder and similar soils: 0 to 3 percent
Windham and similar soils: 0 to 3 percent
Soils that have slopes more than 45 percent: 0 to 3 percent
Areas of rock outcrop: 0 to 3 percent
Soils with stony loam surface layers: 0 to 2 percent
Shallow clayey soils: 0 to 1 percent

Major Component Description

Regent
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Lap
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 1.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Rittel Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Mountains
Parent material: Material derived from semiconsolidated shale
Slope range: 15 to 35 percent
Elevation range: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 20 inches
Frost-free period: 80 to 105 days

Taxonomic Class: Fine, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Rittel loam, in an area of Rittel-Tolex complex, 15 to 35 percent slopes, in an area of forestland, 1,350 feet north and 2,600 feet west of the southeast corner of sec. 9, T. 18 N., R. 7 W.

Oi—2 inches to 0; forest litter of partially decomposed needles, twigs, and roots; abrupt smooth boundary.

A—0 to 1 inch; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and common medium roots; 10 percent angular cobbles and pebbles; moderately acid; clear smooth boundary.

E—1 to 4 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate very thin and thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and common medium and few coarse roots; 10 percent angular pebbles; moderately acid; clear smooth boundary.

Bt/E—4 to 8 inches; 90 percent is pale brown (10YR 6/3) silty clay, dark brown (10YR 4/3) moist (B part); 10 percent is light gray (10YR 7/2) loam, brown (10YR 5/3) moist (E part); strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and few medium and coarse roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 5 percent angular pebbles; slightly acid; abrupt smooth boundary.

Bt1—8 to 15 inches; pale brown (10YR 6/3) silty clay, dark grayish brown (10YR 4/2) moist; strong medium prismatic parting to strong medium and coarse subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—15 to 24 inches; light yellowish brown (2.5Y 6/4) silty clay, olive brown (2.5Y 4/4) moist; strong medium prismatic parting to strong medium and coarse subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—24 to 32 inches; light yellowish brown (2.5Y 6/4) silty clay, olive brown (2.5Y 4/4) moist; very hard, firm, moderately sticky, moderately plastic; common very fine and few medium roots; common very fine tubular and interstitial pores; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Cr—32 to 60 inches; light yellowish brown (2.5Y 6/4) and light brownish gray (2.5Y 6/2) semiconsolidated shale; slightly acid.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr material: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent angular pebbles
Reaction: pH 5.6 to 6.5

E horizon
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent

Content of rock fragments: 0 to 20 percent—0 to 10 percent cobbles; 0 to 10 percent angular pebbles
Reaction: pH 5.6 to 6.5

Bt/E horizon
Hue: 10YR, 7.5YR, or 2.5YR
Value: B part—5 or 6 dry; 4 or 5 moist; E part—6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam, clay, or silty clay
Clay content: 27 to 45 percent (mixed)
Content of rock fragments: 0 to 20 percent pebbles
Reaction: pH 5.6 to 7.3

Bt horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 50 percent
Reaction: pH 5.6 to 7.3

95E—Rittel-Tolex complex, 15 to 35 percent slopes

Setting

Landform:
- Rittel—Mountains
- Tolex—Mountains

Position on landform:
- Rittel—Backslopes
- Tolex—Shoulders

Slope:
- Rittel—15 to 35 percent
- Tolex—15 to 35 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 20 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Rittel and similar soils: 70 percent
Tolex and similar soils: 20 percent

Minor Components
Wayden and similar soils: 0 to 4 percent
Reeder and similar soils: 0 to 3 percent
Soils that are very shallow to bedrock: 0 to 3 percent

Major Component Description

Rittel
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.4 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

600—Riverwash

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,500 to 4,200 feet
Mean annual precipitation: 10 to 19 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Riverwash: 90 percent

Minor Components
Poorly drained soils: 0 to 5 percent
Soils with loamy surfaces: 0 to 5 percent

Major Component Description

Definition: Areas of recently deposited or flood water reworked alluvial material, supporting little or no vegetation
Flooding: Frequent

Rivra Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid to a depth of 6 inches and rapid below
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 3 percent
Elevation range: 3,500 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Ustifluvents

Typical Pedon

Rivra very gravelly loam, in an area of Ryell-Rivra complex, 0 to 3 percent slopes, in an area of rangeland, 1,600 feet south and 2,200 feet west of the northeast corner of sec. 1, T. 21 N., R. 7 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) very gravelly loam, dark brown (10YR 4/3) moist; weak very thin platy parting to weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 10 percent cobbles and 25 percent pebbles; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—6 to 20 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose, slightly sticky, nonplastic; common very fine and few fine and medium roots; 20 percent cobbles and 50 percent pebbles; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—20 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; few very fine roots in upper part; 15 percent cobbles and 55 percent pebbles; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the seasonal high water table: 0 to 42 inches some time during the months of April, May, June, or July

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 5 to 15 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent stones and cobbles; 15 to 50 percent pebbles
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 6.6 to 8.4

C horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sand or loamy sand that consists of strata of these and some finer sands
Clay content: 0 to 5 percent
Content of rock fragments: 55 to 80 percent—10 to 20 percent stones and cobbles; 45 to 70 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

40D—Rock outcrop-Rubble land

Setting

Landform:
- Rock outcrop—Mountains
- Rubble land—Mountains

Position on landform:
- Rock outcrop—Shoulders
- Rubble land—Backslopes and footslopes

Slope:
- Rubble land—35 to 80 percent
- *Elevation:* 4,500 to 7,000 feet

Composition

Major Components
Rock outcrop: 50 percent
Rubble land: 40 percent

Minor Components
Tolex and similar soils: 0 to 10 percent

Major Component Description

Rock outcrop
Definition: Exposures of argillite, limestone, and granite bedrock

Rubble land
Definition: Accumulations of loose rock below areas of rock outcrop

463F—Rock outcrop-Tolex complex, 25 to 80 percent slopes

Setting

Landform:
- Rock outcrop—Mountains
- Tolex—Mountains

Slope:
- Tolex—25 to 80 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Rock outcrop: 55 percent
Tolex and similar soils: 40 percent

Minor Components
Moderately deep soils: 0 to 5 percent

Major Component Description

Rock outcrop
Definition: Hard argillite bedrock

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Rootel Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Bedrock-floored plains
Parent material: Material derived from calcareous argillite bedrock
Slope range: 2 to 8 percent
Elevation range: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Rootel loam, in an area of Rootel-Musselshell loams, 2 to 8 percent slopes, in an area of rangeland, 1,500 feet north and 300 feet east of the southwest corner of sec. 14, T. 11 N., R. 5 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak thin platy parting to weak very fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—4 to 11 inches; pale brown (10YR 6/3) loam, light yellowish brown (10YR 5/4) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; common faint lime coats on faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—11 to 25 inches; white (10YR 8/2) silt loam, light yellowish brown (10YR 6/4) moist; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent channers; disseminated lime; common faint and distinct lime coats on faces of peds; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—25 to 36 inches; very pale brown (10YR 8/3) very channery loam, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; many fine and common very fine roots; many very fine tubular and interstitial pores; 5 percent flagstones and 30 percent channers; disseminated lime; common fine lime coats on surfaces of pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

R—36 inches; hard fractured calcareous argillite bedrock with few very fine roots extending into vertical cracks.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the R horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.9 to 9.0

Bk2 and Bk3 horizons
Hue: 10YR or 2.5Y
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent flagstones; 5 to 30 percent channers
Calcium carbonate equivalent: 25 to 35 percent
Reaction: pH 7.9 to 9.0

41C—Rootel-Musselshell loams, 2 to 8 percent slopes

Setting

Landform:
- Rootel—Bedrock-floored plains
- Musselshell—Alluvial fans

Slope:
- Rootel—2 to 8 percent
- Musselshell—2 to 8 percent

Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Rootel and similar soils: 55 percent
Musselshell and similar soils: 35 percent

Minor Components
Pensore and similar soils: 0 to 4 percent
Amesha and similar soils: 0 to 3 percent
Soils that have gravelly loam surface layers: 0 to 3 percent

Major Component Description

Rootel
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Argillite residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Musselshell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Rothiemay Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 2 to 8 percent
Elevation range: 3,800 to 4,300 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Calciustolls

Typical Pedon

Rothiemay silt loam, 2 to 8 percent slopes, in an area of rangeland, 2,100 feet south and 50 feet west of the northeast corner of sec. 10, T. 20 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, moderately sticky, slightly plastic; many very fine roots; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bw—5 to 16 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure; soft, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 2 percent pebbles; continuous fine lime casts on undersides of pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk1—16 to 50 inches; light gray (2.5Y 7/2) loam stratified with thin layers of silt loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; many fine seams and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—50 to 60 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; disseminated lime; few fine seams and soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the calcic horizon: 13 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Chroma: 1 or 2
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 35 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 5 to 20 percent
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

136C—Rothiemay silt loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 3,800 to 4,300 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Rothiemay and similar soils: 95 percent

Minor Components
Sappington and similar soils: 0 to 2 percent
Soils that have slopes more than 8 percent: 0 to 2 percent
Soils with gravelly silt loam surfaces: 0 to 1 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Ryell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 35 inches and rapid below
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 3 percent
Elevation range: 3,500 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid Aridic Ustifluvents

Typical Pedon

Ryell loam, in an area of Ryell-Rivra complex, 0 to 3 percent slopes, in an area of cropland, 1,800 feet south and 1,600 feet west of the northeast corner of sec. 1, T. 21 N., R. 7 W.

Ap—0 to 6 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—6 to 16 inches; light brownish gray (2.5Y 6/2) loam, with thin strata of silt loam, dark grayish brown (2.5Y 4/2) moist; massive; many distinct bedding planes; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—16 to 23 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; slightly alkaline; gradual smooth boundary.

C3—23 to 35 inches; pale brown (10YR 6/3) sandy loam with thin strata of loam, dark brown (10YR 5/4) moist; few fine distinct reddish yellow (7.5YR 6/6) mottles; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

2C4—35 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; 15 percent cobbles and 45 percent pebbles; disseminated lime; strongly effervescent; mildly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the 2C horizon: 18 to 36 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 10 to 27 percent
Electrical conductivity: 0 to 2 mmhos/cm
Effervescence: None to strongly
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.4 to 8.4

C horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Very fine sandy loam, loamy very fine sand, or loam consisting of very fine sandy loam with thin strata of loam, silt loam, and/or fine sandy loam
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2C4 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 70 percent—0 to 15 percent cobbles; 35 to 55 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

117A—Ryell-Rivra complex, 0 to 3 percent slopes

Setting

Landform:
- Ryell—Flood plains
- Rivra—Flood plains

Slope:
- Ryell—0 to 3 percent
- Rivra—0 to 3 percent

Elevation: 3,500 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Ryell and similar soils: 55 percent
Rivra and similar soils: 35 percent

Minor Components
Havre and similar soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent
Soils with very cobbly loam surfaces: 0 to 2 percent
Soils that have slopes more than 3 percent: 0 to 2 percent

Major Component Description

Ryell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Available water capacity: Mainly 6.6 inches

Rivra
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Depth to the seasonal high water table: Apparent, 0 to 42 inches
Available water capacity: Mainly 1.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

212A—Ryell loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Ryell and similar soils: 90 percent

Minor Components
Havre and similar soils: 0 to 5 percent
Soils that are shallow to sand and gravel: 0 to 5 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 6.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Sappington Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 1 to 8 percent
Elevation range: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Calcidic Argiustolls

Typical Pedon

Sappington loam, in an area of Sappington-Amesha loams, 1 to 4 percent slopes, in an area of cropland, 50 feet north and 2,450 feet east of the southwest corner of sec. 27, T. 10 N., R. 2 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common

very fine and fine roots; 1 percent pebbles; slightly alkaline; abrupt smooth boundary.

Bt—4 to 6 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic parting to moderate fine angular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; 1 percent pebbles; slightly alkaline; abrupt smooth boundary.

Btk—6 to 9 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; few distinct clay films on faces of peds; 1 percent pebbles; common distinct lime coats on faces of peds; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—9 to 20 inches; white (10YR 8/2) loam, very pale brown (10YR 7/3) moist; weak coarse prismatic structure; hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; 1 percent pebbles; disseminated lime; many distinct lime coats on faces of peds; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—20 to 34 inches; very pale brown (10YR 8/3) loam, very pale brown (10YR 6/3) moist; weak coarse angular blocky structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine and fine tubular and interstitial pores; 2 percent pebbles; disseminated lime; few fine soft masses of lime; few distinct lime coats on faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

Bk3—34 to 72 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky, slightly plastic; few very fine roots; few very fine tubular and interstitial pores; 2 percent pebbles; few fine soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Thickness of the mollic epipedon: 7 to 9 inches; includes part of the Bt horizon

Depth to lime: 6 to 10 inches

Ap horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry; 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 30 percent—0 to 5 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 3 or 4
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 25 percent pebbles
Reaction: pH 6.6 to 7.8

Btk horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 15 to 27 percent (10 to 18 percent noncarbonate clay)
Content of rock fragments: 0 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bk1 and Bk2 horizons

Hue: 7.5YR, 10YR, or 2.5Y
Value: 7 or 8 dry; 5 to 7 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 15 to 27 percent (10 to 18 percent noncarbonate clay)
Content of rock fragments: 0 to 25 percent pebbles
Calcium carbonate equivalent: 20 to 40 percent
Reaction: pH 7.9 to 8.4

Bk3 horizon

Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 15 to 27 percent (10 to 18 percent noncarbonate clay)
Content of rock fragments: 0 to 25 percent pebbles
Calcium carbonate equivalent: 20 to 40 percent
Reaction: pH 7.9 to 8.4

33B—Sappington-Amesha loams, 1 to 4 percent slopes

Setting

Landform:
- Sappington—Alluvial fans
- Amesha—Alluvial fans

Slope:
- Sappington—1 to 4 percent
- Amesha—1 to 4 percent

Elevation: 3,800 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Sappington and similar soils: 60 percent
Amesha and similar soils: 35 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 3 percent
Very deep gravelly loam soils: 0 to 2 percent

Major Component Description

Sappington
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.2 inches

Amesha
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

33C—Sappington-Amesha loams, 4 to 8 percent slopes

Setting

Landform:
- Sappington—Alluvial fans
- Amesha—Alluvial fans

Position on landform:
- Sappington—Backslopes and footslopes
- Amesha—Shoulders

Slope:
- Sappington—4 to 8 percent
- Amesha—4 to 8 percent

Elevation: 3,800 to 4,300 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Sappington and similar soils: 50 percent
Amesha and similar soils: 40 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 4 percent
Soils with gravelly loam surface layers: 0 to 4 percent
Very gravelly loam soils: 0 to 2 percent

Major Component Description

Sappington
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.2 inches

Amesha
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

533B—Sappington-Musselshell gravelly loams, 2 to 8 percent slopes

Setting

Landform:
- Sappington—Alluvial fans
- Musselshell—Alluvial fans

Slope:
- Sappington—2 to 8 percent
- Musselshell—2 to 8 percent

Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Sappington and similar soils: 50 percent
Musselshell and similar soils: 40 percent

Minor Components
Soils with very gravelly loam surfaces: 0 to 5 percent
Soils with more rock fragments: 0 to 5 percent

Major Component Description

Sappington
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.0 inches

Musselshell
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Sawbuck Series

Depth class: Very deep (more than 60 inches) or deep (40 to 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium from igneous and sedimentary rock
Slope range: 15 to 60 percent
Elevation range: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 24 inches
Frost-free period: 80 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Sawbuck loam, 15 to 45 percent slopes, in an area of forestland, 1,400 feet north and 1,300 feet east of the southwest corner of sec. 4, T. 14 N., R. 2 W.

Oi—1 inch to 0; forest litter of partially decomposed twigs and needles.

A1—0 to 6 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium and coarse roots; 5 percent angular pebbles; slightly acid; gradual smooth boundary.

A2—6 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium and coarse roots; many gray silt and sand skeletans on faces of peds; 5 percent angular pebbles; moderately acid; gradual smooth boundary.

Bt1—9 to 15 inches; brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common distinct dark brown (10YR 3/3) moist clay films on faces of peds; many faint gray silt and sand skeletans on faces of peds; 5 percent angular cobbles and 25 percent angular pebbles; moderately acid; clear smooth boundary.

Bt2—15 to 40 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) moist; strong fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine and few

medium roots; common very fine and fine tubular and interstitial pores; many distinct dark brown (10YR 3/3) moist clay films on faces of peds and lining pores; 5 percent angular cobbles and 45 percent angular pebbles; moderately acid; gradual smooth boundary.

Bt3—40 to 48 inches; light gray (2.5Y 7/2) very gravelly silty clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; many faint light gray (2.5Y 7/2) silt and sand skeletans on faces of peds; common distinct pale yellow (2.5Y 7/4) stains on faces of peds and on coarse rock fragments; 5 percent angular cobbles and 40 percent angular pebbles; moderately acid; gradual smooth boundary.

Bt4—48 to 60 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; few very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; common distinct pale yellow (2.5Y 7/4) stains on faces of peds and on coarse rock fragments; 15 percent angular sandstone and shale fragments; moderately acid.

Range in Characteristics

Soil temperature: 40 to 45 degrees F
Thickness of the mollic epipedon: 10 to 15 inches
Depth to the argillic horizon: 5 to 16 inches
Soil phases: Shale substratum

A horizons
Value: 4 or 5 dry; 3 moist
Chroma: 1 or 2
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent stones; 0 to 5 percent angular cobbles; 0 to 5 percent angular pebbles
Reaction: pH 5.6 to 6.5

Bt1 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam or loam
Clay content: 25 to 30 percent
Content of rock fragments: 15 to 35 percent—5 to 10 percent angular cobbles; 10 to 35 percent angular pebbles
Reaction: pH 5.6 to 6.5

Bt2 and Bt3 horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam or silty clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 35 to 60 percent—5 to 10 percent angular cobbles; 30 to 50 percent angular pebbles
Reaction: pH 5.6 to 6.5

Bt4 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Silty clay loam or clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 15 to 60 percent—5 to 10 percent angular cobbles; 10 to 50 percent angular pebbles
Reaction: pH 5.6 to 6.5

71E—Sawbuck loam, 15 to 45 percent slopes

Setting

Landform: Mountains
Slope: 15 to 45 percent
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 24 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Sawbuck and similar soils: 90 percent

Minor Components
Soils with bedrock at less than 40 inches: 0 to 3 percent
Soils that have slopes more than 45 percent: 0 to 3 percent
Soils with stony surface layers: 0 to 2 percent
Soils with less rock fragments: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Igneous colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 7.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

171E—Sawbuck-Tolex complex, 15 to 45 percent slopes

Setting

Landform:
- Sawbuck—Mountains
- Tolex—Mountains

Position on landform:
- Sawbuck—Backslopes
- Tolex—Shoulders

Slope:
- Sawbuck—15 to 45 percent
- Tolex—14 to 45 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 24 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Sawbuck and similar soils: 70 percent
Tolex and similar soils: 20 percent

Minor Components
Very shallow soils: 0 to 4 percent
Areas of rock outcrop: 0 to 3 percent
Extremely gravelly deep soils: 0 to 3 percent

Major Component Description

Sawbuck
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Igneous colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 7.1 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

271F—Sawbuck-Sawbuck, shale substratum, loams, 25 to 60 percent slopes

Setting

Landform:
- Sawbuck—Mountains
- Sawbuck—Mountains

Slope:
- Sawbuck—25 to 60 percent
- Sawbuck—25 to 60 percent

Elevation: 5,000 to 5,500 feet
Mean annual precipitation: 15 to 24 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Sawbuck and similar soils: 45 percent
Sawbuck and similar soils: 40 percent

Minor Components
Tolex and similar soils: 0 to 5 percent
Soils with shale at less than 40 inches: 0 to 4 percent
Soils with less rock fragments: 0 to 3 percent
Soils that have slopes less than 25 percent: 0 to 3 percent

Major Component Description

Sawbuck
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Igneous colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 7.1 inches

Sawbuck
Surface layer texture: Loam
Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Dominant parent material: Shale residuum

Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Scravo Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 6 inches, moderately rapid from 6 to 17 inches, and rapid below
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Calciustepts

Typical Pedon

Scravo gravelly loam, 0 to 2 percent slopes, in an area of cropland, 250 feet north and 50 feet east of the southwest corner of sec. 19, T. 11 N., R. 3 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 20 percent pebbles; continuous prominent lime casts on undersides of pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—6 to 17 inches; light gray (10YR 7/2) extremely gravelly sandy loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; 65 percent pebbles; many fine soft masses of lime; continuous prominent lime casts on undersides of pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—17 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine roots; 65 percent pebbles; common prominent lime an silica casts on undersides of pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Bk horizon: 3 to 6 inches
Depth to the 2Bk horizon: 9 to 20 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 7.8

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Sandy loam or loam
Clay content: 5 to 15 percent
Content of rock fragments: 35 to 70 percent—0 to 10 percent cobbles; 35 to 65 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

2Bk2 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loamy sand or sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—0 to 15 percent cobbles; 35 to 65 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 10 to 30 percent
Reaction: pH 7.9 to 8.4

9A—Scravo gravelly loam, 0 to 2 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 2 percent
Elevation: 3,600 to 4,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Scravo and similar soils: 90 percent

Minor Components
Nippt and similar soils: 0 to 7 percent
Soils with loam surface layers: 0 to 3 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Shadow Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Mountains
Parent material: Colluvium derived from argillite and igneous rock
Slope range: 25 to 60 percent
Elevation range: 6,500 to 7,800 feet
Mean annual Precipitation: 25 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Eutrocryepts

Typical Pedon

Shadow channery loam, in an area of Shadow-Cowood complex, 25 to 60 percent slopes, in an area of forestland, 2,100 feet north and 1,900 feet west of the southeast corner of sec. 19, T. 14 N., R. 5 W.

Oi—2 inches to 0; forest litter of partially decomposed needles, twigs, and roots; abrupt smooth boundary.

A—0 to 3 inches; light brownish gray (10YR 6/2) channery loam, dark brown (10YR 4/3) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; many gray silt and sand skeletans on faces of peds; 20 percent channers; strongly acid; clear smooth boundary.

E1—3 to 8 inches; pale brown (10YR 6/3) very channery loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and common medium roots; many very fine tubular and interstitial pores; many gray silt and sand skeletans on faces of peds; 50 percent channers; strongly acid; gradual smooth boundary.

E2—8 to 25 inches; pale brown (10YR 6/3) extremely channery sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 10 percent flagstones and 60 percent channers; rock fragments coated with gray silt and sand skeletans; strongly acid; clear wavy boundary.

Bw—25 to 40 inches; pinkish gray (7.5YR 6/2) extremely channery loam, dark brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds; common faint gray silt and sand skeletans on faces of ped; 5 percent flagstones and 60 percent channers; strongly acid; gradual wavy boundary.

BC1—40 to 50 inches; pinkish gray (7.5YR 6/2) extremely channery sand, dark brown (7.5YR 4/2) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 75 percent channers coated with few faint gray silt and sand grains; strongly acid; clear smooth boundary.

BC2—50 to 60 inches; brown (7.5YR 5/2) extremely channery sandy loam, dark brown (7.5YR 4/2) moist; weak fine and medium subangular blocky parting to weak fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine interstitial pores; 5 percent flagstones and 60 percent channers; strongly acid.

Range in Characteristics

Soil temperature: 38 to 44 degrees F
Base saturation: 50 to 100 percent

A horizon
Hue: 7.5YR or 10YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 5 to 15 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent stones and flagstones; 15 to 30 percent channers
Reaction: pH 5.1 to 6.0

E horizons
Hue: 10YR or 7.5YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 5 to 15 percent—55 to 80 percent sand of which 5 to 15 percent is very fine sand and 15 to 40 percent is mica
Content of rock fragments: 40 to 70 percent—0 to 10 percent flagstones; 40 to 60 percent channers
Reaction: pH 5.1 to 6.0

Bw horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sandy loam or loam
Clay content: 5 to 15 percent—55 to 80 percent sand of which 5 to 15 percent is very fine sand and 15 to 40 percent is mica
Content of rock fragments: 60 to 80 percent—0 to 10 percent flagstones; 60 to 70 percent channers
Reaction: pH 5.1 to 6.0

BC horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sand or sandy loam
Clay content: 5 to 15 percent—55 to 80 percent sand of which 5 to 15 percent is very fine sand and 15 to 40 percent is mica
Content of rock fragments: 60 to 85 percent—0 to 10 percent flagstones; 60 to 75 percent channers
Reaction: pH 5.1 to 6.0

190F—Shadow-Cowood complex, 25 to 60 percent slopes

Setting

Landform:
- Shadow—Mountains
- Cowood—Mountains

Position on landform:
- Shadow—Backslopes and footslopes
- Cowood—Shoulders

Slope:
- Shadow—25 to 60 percent
- Cowood—25 to 60 percent

Elevation: 6,500 to 7,800 feet
Mean annual precipitation: 25 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Shadow and similar soils: 80 percent
Cowood and similar soils: 15 percent

Minor Components
Very shallow soils: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils with stony loam surface layers: 0 to 1 percent

Major Component Description

Shadow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.4 inches

Cowood
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Shawa Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 8 to 15 percent
Elevation range: 3,600 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Pachic Haplustolls

Typical Pedon

Shawa loam, in an area of Shawa-Castner-Rock outcrop complex, 8 to 45 percent slopes, in an area of rangeland, 800 feet north and 1,500 feet west of the southeast corner of sec. 13, T. 15 N., R. 3 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; neutral; clear smooth boundary.

A2—5 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; neutral; clear smooth boundary.

A3—12 to 18 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; neutral; clear smooth boundary.

Bw—18 to 27 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; neutral; clear smooth boundary.

Bk—27 to 50 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; common fine soft masses and threads of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—50 to 60 inches; olive gray (5Y 5/2) gravelly sandy loam, olive gray (5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; 15 percent pebbles; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 16 to 25 inches

A horizons
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 25 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sandy loam or loam
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

C horizon
Hue: 2.5Y or 5Y
Value: 5 to 7 dry; 3 or 4 moist
Chroma: 1 to 3
Texture: Loam or sandy loam
Clay content: 10 to 20 percent

Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 3 to 10 percent
Reaction: pH 7.4 to 8.4

88B—Shawa loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 3,600 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shawa and similar soils: 95 percent

Minor Components
Farnuf and similar soils: 0 to 2 percent
Soils with more rock fragments: 0 to 1 percent
Soils that have slopes more than 8 percent: 0 to 1 percent
Very deep sandy loam soils: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

161E—Shawa-Castner-Rock outcrop complex, 8 to 45 percent slopes

Setting

Landform:
- Shawa—Alluvial fans
- Castner—Hills

Position on landform:
- Shawa—Footslopes and toeslopes
- Castner—Backslopes and shoulders
- Rock outcrop—Backslopes and shoulders

Slope:
- Shawa—8 to 15 percent
- Castner—8 to 45 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shawa and similar soils: 40 percent
Castner and similar soils: 35 percent
Rock outcrop: 15 percent

Minor Components
Soils with extremely channery subsoils: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Shawa
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

Castner
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

Rock outcrop
Definition: Hard igneous bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

861D—Shawa-Farnuf-Castner complex, 4 to 25 percent slopes

Setting

Landform:
- Shawa—Alluvial fans
- Farnuf—Alluvial fans
- Castner—Hills

Position on landform:
- Shawa—Footslopes and toeslopes
- Farnuf—Footslopes and toeslopes
- Castner—Backslopes and shoulders

Slope:
- Shawa—4 to 15 percent
- Farnuf—4 to 15 percent
- Castner—8 to 25 percent

Elevation: 3,600 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shawa and similar soils: 40 percent
Farnuf and similar soils: 30 percent
Castner and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Shawa
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

Farnuf
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

Castner
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Igneous residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Shawmut Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 1 to 25 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Shawmut gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 1,300 feet north and 200 feet west of the southeast corner of sec. 1, T. 19 N., R. 8 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 30 percent pebbles; slightly alkaline; clear smooth boundary.

Bt1—4 to 9 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds and on fragments; 45 percent pebbles; slightly alkaline; clear smooth boundary.

Bt2—9 to 15 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 50 percent pebbles; slightly alkaline; clear smooth boundary.

Btk—15 to 20 inches; pale brown (10YR 6/3) extremely gravelly loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds; 60 percent pebbles; continuous distinct lime casts on undersides of pebbles; disseminated lime; common fine seams and soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—20 to 45 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; 70 percent pebbles; continuous distinct lime casts on undersides of pebbles; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bk2—45 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, very friable, nonsticky, nonplastic; 70 percent pebbles; continuous faint lime casts on undersides of pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the calcic horizon: 9 to 20 inches

A horizon
Hue: 7.5YR or 10YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 60 percent—0 to 10 percent cobbles; 15 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

Bt1 horizon
Hue: 7.5YR or 10YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Sandy clay loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

Bt2 horizon
Hue: 7.5YR or 10YR
Value: 3 to 5 dry; 2 to 4 moist
Chroma: 2 or 3
Texture: Sandy clay loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 80 percent—0 to 15 percent stones; 0 to 20 percent cobbles; 30 to 60 percent pebbles
Reaction: pH 7.9 to 8.4

Btk horizon
Hue: 7.5YR or 10YR
Value: 3 to 6 dry; 2 to 5 moist
Chroma: 2 or 3
Texture: Clay loam, loam, or sandy loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 80 percent—0 to 20 percent stones; 0 to 20 percent cobbles; 30 to 60 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 8.4

Bk1 horizon
Hue: 2.5Y or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Sandy loam, clay loam, or loam
Clay content: 15 to 30 percent
Content of rock fragments: 35 to 80 percent—0 to 20 percent stones; 0 to 20 percent cobbles; 30 to 75 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 8.4

2Bk2 horizon
Hue: 2.5Y or 10YR
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 or 3
Texture: Sandy loam, loamy sand, or loam
Clay content: 5 to 25 percent
Content of rock fragments: 50 to 85 percent—0 to 20 percent stones; 0 to 20 percent cobbles; 45 to 70 percent pebbles
Calcium carbonate equivalent: 10 to 25 percent
Electrical conductivity: Less than 2 mmhos/cm
Reaction: pH 7.9 to 9.0

154D—Shawmut-Beaverton very gravelly loams, 8 to 25 percent slopes

Setting

Landform:
- Shawmut—Stream terraces
- Beaverton—Stream terraces

Slope:
Shawmut—8 to 25 percent
Beaverton—8 to 25 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shawmut and similar soils: 70 percent
Beaverton and similar soils: 20 percent

Minor Components
Soils that have slopes more than 25 percent: 0 to 3 percent
Soils with cobbly loam surface layers: 0 to 3 percent
Soils with stony loam surface layers: 0 to 2 percent
Soils that are calcareous throughout: 0 to 2 percent

Major Component Description

Shawmut
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Beaverton
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

167C—Shawmut gravelly loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shawmut and similar soils: 90 percent

Minor Components
Beaverton and similar soils: 0 to 4 percent
Soils that have slopes more than 8 percent: 0 to 3 percent
Soils with very gravelly loam surfaces: 0 to 3 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Sieben Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and mountains
Parent material: Alluvium, colluvium from argillite, and igneous rock
Slope range: 2 to 35 percent
Elevation range: 4,000 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Calcidic Argiustolls

Typical Pedon

Sieben gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 1,900 feet south and 50 feet east of the northwest corner of sec. 15, T. 13 N., R. 4 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine

roots; 20 percent angular pebbles; slightly acid; clear smooth boundary.

A2—5 to 9 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 20 percent angular pebbles; slightly acid; clear smooth boundary.

Bt1—9 to 17 inches; pale brown (10YR 6/3) very gravelly clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct brown (10YR 5/3) clay films on faces of peds; 45 percent angular pebbles; slightly acid; gradual smooth boundary.

Bt2—17 to 21 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds and on coarse rock fragments; 5 percent angular cobbles and 55 percent angular pebbles; few faint lime casts on undersides of coarse rock fragments; slightly alkaline; gradual smooth boundary.

Bk1—21 to 30 inches; very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 10 percent angular cobbles and 45 percent angular pebbles; continuous distinct thick lime casts on undersides of rock fragments; many fine seams and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—30 to 41 inches; very pale brown (10YR 7/3) extremely gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 20 percent angular cobbles and 55 percent angular pebbles; continuous faint lime casts with cemented sand and fine pebbles on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—41 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; 15 percent angular cobbles and 60 percent angular pebbles; continuous faint lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to lime: 15 to 25 inches

A horizons
Value: 5 dry; 3 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 10 percent stones; 0 to 5 percent angular cobbles; 15 to 20 percent angular pebbles
Reaction: pH 6.1 to 7.3

Bt1 horizon
Value: 5 or 6 dry; 4 moist
Chroma: 3 or 4
Clay content: 30 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 0 to 5 percent angular cobbles; 35 to 50 percent angular pebbles
Reaction: pH 6.1 to 7.3

Bt2 horizon
Value: 5 or 6 dry; 4 moist
Chroma: 3 or 4
Clay content: 15 to 25 percent
Content of rock fragments: 50 to 70 percent—0 to 5 percent angular cobbles; 50 to 65 percent angular pebbles
Reaction: pH 6.6 to 7.8

Bk1 and Bk2 horizons
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 10 to 25 percent
Content of rock fragments: 50 to 80 percent—5 to 20 percent angular cobbles; 45 to 60 percent angular pebbles
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.9 to 8.4

Bk3 horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 5 to 15 percent

Content of rock fragments: 50 to 80 percent—5 to 20 percent angular cobbles; 45 to 60 percent angular pebbles
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.4 to 8.4

34B—Sieben gravelly loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 4,000 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Sieben and similar soils: 95 percent

Minor Components
Soils with less rock fragments: 0 to 3 percent
Soils with less lime: 0 to 2 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

243C—Sieben stony loam, 2 to 15 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 15 percent
Elevation: 4,000 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Sieben and similar soils: 95 percent

Minor Components
Soils without stones: 0 to 3 percent
Soils with sand and gravel at 2 feet: 0 to 2 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Silvercity Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 24 inches and rapid below
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 20 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Loamy-skeletal over sandy or sandy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Silvercity gravelly loam, 1 to 4 percent slopes, in an area of rangeland, 1,500 feet north and 1,980 feet west of the southeast corner of sec. 21, T. 14 N., R. 9 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate very thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky,

slightly plastic; many very fine roots; 15 percent pebbles; neutral; clear smooth boundary.

Bt1—6 to 10 inches; brown (10YR 5/3) gravelly clay loam, dark brown (10 YR 3/3) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; common faint clay films on faces of peds; 5 percent cobbles and 20 percent pebbles; neutral; clear smooth boundary.

Bt2—10 to 24 inches; brown (10YR 5/3) very gravelly clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many faint clay films on faces of peds and on coarse rock fragments; 15 percent cobbles and 35 percent pebbles; slightly alkaline; clear smooth boundary.

2Bk—24 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky, nonplastic; few very fine roots in upper part; 25 percent cobbles and 40 percent pebbles; common distinct lime casts on undersides of larger coarse rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 40 to 45 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the sandy skeletal material: 20 to 40 inches

A horizon
Value: 2 or 3 moist
Chroma: 1 or 2
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent pebbles
Reaction: pH 6.6 to 7.3

Bt1 horizon
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 25 to 60 percent—5 to 10 percent cobbles; 20 to 50 percent pebbles
Reaction: pH 6.6 to 7.3

Bt2 horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 3 or 4
Texture: Loam or clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 35 to 60 percent—5 to 10 percent cobbles; 30 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

2Bk horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 6 moist
Chroma: 2 or 3
Texture: Loamy sand or sand
Clay content: 0 to 5 percent
Content of rock fragments: 60 to 80 percent—10 to 20 percent cobbles; 50 to 60 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

4B—Silvercity gravelly loam, 1 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 1 to 4 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 20 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Silvercity and similar soils: 95 percent

Minor Components
Soils with loamy sand at deeper depths: 0 to 3 percent
Soils with loamy sand at shallower depths: 0 to 2 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

254A—Silvercity-Wabek gravelly loams, 0 to 3 percent slopes

Setting

Landform:
- Silvercity—Stream terraces
- Wabek—Stream terraces

Slope:
- Silvercity—0 to 3 percent
- Wabek—0 to 3 percent

Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 20 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Silvercity and similar soils: 75 percent
Wabek and similar soils: 20 percent

Minor Components
Soils that have slopes more than 3 percent: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 2 percent
Soils with very gravelly loam at 2 feet: 0 to 1 percent

Major Component Description

Silvercity
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

Wabek
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Silverking Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderate to a depth of 24 inches and rapid below
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 3 percent
Elevation range: 4,400 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aquic Ustochrepts

Typical Pedon

Silverking silt loam, 0 to 3 percent slopes, in an area of forestland, 1,200 feet north and 100 feet west of the southeast corner of sec. 18, T. 14 N., R. 8 W.

Oi—1 inch to 0; forest litter of slightly decomposed needles, twigs, and roots.

A—0 to 4 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many light gray silt and sand skeletans on faces of peds; common worm casts; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 24 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; common fine and medium distinct strong brown (7.5YR 4/6) moist redox concentrations; weak medium prismatic structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common worm casts and krotovinas in upper part; strongly effervescent; moderately alkaline; gradual smooth boundary.

2C—24 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky, nonplastic; 20 percent cobbles and 45 percent pebbles; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 45 degrees F
Depth to the 2C horizon: 20 to 40 inches
Depth to the seasonal high water table: 24 to 42 inches

A horizon
Value: 3 or 4 moist; 5 or 6 dry
Clay content: 18 to 25 percent
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 7.5YR
Value: 4 or 5 moist (mottles), 6 or 7 dry; 4 or 5 moist, 5 or 6 dry
Chroma: 3 or 4 (mottles); 3, 4, or 6
Texture: Loam or silt loam
Clay content: 18 to 25 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2C horizon
Clay content: 0 to 5 percent
Content of rock fragments: 60 to 75 percent—0 to 10 percent cobbles; 60 to 65 percent pebbles
Reaction: pH 7.4 to 8.4

7A—Silverking silt loam, 0 to 3 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 3 percent
Elevation: 4,400 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Silverking and similar soils: 85 percent

Minor Components
Well drained soils: 0 to 4 percent
Poorly drained soils: 0 to 4 percent
Very deep loamy soils: 0 to 4 percent
Soils with gravelly loam surface layers: 0 to 3 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Forestland
Flooding: Occasional
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Sinnigam Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills
Parent material: Material derived from hard shale and sandstone
Slope range: 8 to 45 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Clayey-skeletal, mixed, superactive, frigid Lithic Argiustolls

Typical Pedon

Sinnigam channery loam, in an area of Sinnigam-Regent complex, 15 to 45 percent slopes, in an area of rangeland, 2,600 feet north and 1,700 feet east of the southwest corner of sec. 12, T. 15 N., R. 4 W.

A—0 to 4 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, moderately sticky, slightly plastic; many very fine roots; 30 percent channers; slightly acid; clear smooth boundary.

Bt1—4 to 8 inches; grayish brown (10YR 5/2) very channery clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds and on coarse rock fragments; 50 channers; neutral; gradual smooth boundary.

Bt2—8 to 17 inches; grayish brown (10YR 5/2) extremely channery silty clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct very dark grayish brown (10YR 3/2) moist clay films on faces of

peds and on coarse rock fragments; 65 percent channers; neutral; gradual smooth boundary.

R—17 inches; hard fractured interbedded sandstone and shale; few very fine roots in cracks; few faint lime coats on undersides of some rock fragments.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 12 inches; includes all or part of the argillic horizon
Depth to bedrock: 10 to 20 inches

A horizon
Hue: 7.5YR or 10YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Content of rock fragments: 15 to 35 percent channers
Reaction: pH 6.1 to 7.8

Bt1 horizon
Hue: 10YR, 7.5YR, or 5YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 50 percent
Content of rock fragments: 35 to 70 percent—15 to 35 percent stones and cobbles; 20 to 70 percent pebbles or channers
Reaction: pH 6.1 to 7.8

Bt2 horizon
Hue: 10YR, 7.5YR, or 5YR
Value: 4 or 5 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 50 percent
Content of rock fragments: 35 to 70 percent—15 to 30 percent stones and cobbles; 20 to 70 percent pebbles or channers
Reaction: pH 6.1 to 7.8

779E—Sinnigam-Regent complex, 15 to 45 percent slopes

Setting

Landform:
- Sinnigam—Hills
- Regent—Hills

Position on landform:
- Sinnigam—Backslopes and shoulders
- Regent—Backslopes and footslopes

Slope:
- Sinnigam—15 to 45 percent
- Regent—15 to 35 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Sinnigam and similar soils: 70 percent
Regent and similar soils: 20 percent

Minor Components
Work and similar soils: 0 to 3 percent
Castner and similar soils: 0 to 3 percent
Soils that have slopes more than 45 percent: 0 to 2 percent
Very shallow soils: 0 to 2 percent

Major Component Description

Sinnigam
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Interbedded sandstone and shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.5 inches

Regent
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded sandstone and shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Slategoat Series

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Stream terraces

Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Typic Haplustepts

Typical Pedon

Slategoat silt loam, 0 to 2 percent slopes, in an area of forestland, 2,100 feet south and 100 feet west of the northeast corner of sec. 24, T. 14 N., R. 9 W.

Oi—1 inch to 0; forest litter of slightly decomposed needles, twigs, and leaves.

A—0 to 7 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and few medium roots; common light gray silt and sand skeletans on faces of peds; neutral; clear smooth boundary.

AB—7 to 12 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and few medium roots; many very fine tubular and interstitial pores; common light gray silt and sand skeletans on faces of peds; slightly alkaline; gradual smooth boundary.

Bw—12 to 21 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic parting to moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial and few medium tubular pores; slightly alkaline; gradual smooth boundary.

Bk1—21 to 38 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial and few medium tubular pores; common fine irregular seams of lime; disseminated lime; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bk2—38 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; common fine prominent yellowish brown (10YR 5/6) moist redox concentrations; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and medium roots; many very fine tubular and interstitial pores; common fine irregular seams of lime; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 45 degrees F
Depth to the Bk horizon: 15 to 30 inches
Depth to the seasonal high water table: 60 to 72 inches from May through July

A horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 1 or 2
Clay content: 18 to 25 percent
Reaction: pH 6.1 to 7.3

AB horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Reaction: pH 6.1 to 7.8

Bw horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry
Chroma: 3 or 4
Texture: Loam or silt loam
Clay content: 18 to 25 percent
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 10YR or 7.5YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or silt loam
Clay content: 18 to 25 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

609A—Slategoat silt loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Slategoat and similar soils: 90 percent

Minor Components
Stady, cool soils: 0 to 4 percent
Poorly drained soils: 0 to 1 percent
Soils with sand and gravel at 30 inches: 0 to 3 percent
Soils with gravelly loam surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Forestland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 60 to 72 inches
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Soapcreek Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Flood plains and low stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 4,000 to 5,000 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 120 days

Taxonomic Class: Fine, mixed, superactive, frigid Fluvaquentic Haplustolls

Typical Pedon

Soapcreek silty clay, 0 to 2 percent slopes, in an area of irrigated hayland, 500 feet south and 700 feet west of the northeast corner of sec. 18, T. 11 N., R. 4 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong very fine granular structure; hard, firm, moderately sticky, moderately plastic; many very fine roots; many fine tubular and interstitial pores; moderately alkaline; clear smooth boundary.

A—5 to 12 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; strong very fine and fine subangular blocky structure; hard, firm, moderately sticky, moderately plastic; many very fine roots; many very fine tubular and interstitial pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk—12 to 20 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; moderate very fine and fine granular structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bkg—20 to 30 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; common medium prominent light brown (7.5YR 6/4) redox concentrations, dark brown (7.5YR 4/4) moist; weak very fine and fine granular structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bg1—30 to 40 inches; gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; common medium prominent light yellowish brown (2.5Y 6/4) redox concentrations, light olive brown (2.5Y 5/4) moist; massive; hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; slightly alkaline; gradual smooth boundary.

Bg2—40 to 60 inches; gray (5Y 6/1) silty clay, gray (5Y 4/1) moist; common medium faint light olive gray (5Y 6/2) redox depletions; massive; hard, firm, moderately sticky, moderately plastic; few very fine roots; 5 percent pebbles and pieces of charcoal; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 10 to 15 inches
Depth to the seasonal high water table: 24 to 42 inches

A horizons
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Clay content: 40 to 50 percent
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 moist; 5 or 6 dry
Chroma: 1 or 2
Texture: Silty clay or silty clay loam
Clay content: 35 to 50 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

Bkg horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 moist; 5 or 6 dry
Chroma: 1 or 2
Texture: Silty clay or silty clay loam
Clay content: 35 to 50 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

Bg1 horizon
Hue: 2.5Y or 5Y
Value: 4 or 5 moist; 6 dry
Chroma: 1 or 2
Texture: Silty clay or silty clay loam
Clay content: 35 to 50 percent
Reaction: pH 7.4 to 8.4

Bg2 horizon
Hue: 2.5Y or 5Y
Value: 4 or 5 moist; 6 dry
Chroma: 1 or 2
Texture: Mainly silty clay loam or silty clay but includes thin strata of fine sandy loam, loam, and silt loam
Clay content: 25 to 45 percent
Reaction: pH 7.4 to 8.4

508A—Soapcreek silty clay, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Soapcreek and similar soils: 95 percent

Minor Components
Fairway and similar soils: 0 to 2 percent
Poorly drained soils: 0 to 2 percent
Soils with silty clay loam surfaces: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 9.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Stady Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to a depth of 29 inches and rapid below
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Typic Haplustolls

Typical Pedon

Stady silt loam, in an area of Stady-Wabek complex, 1 to 4 percent slopes, in an area of rangeland, 1,400 feet south and 100 feet east of the northwest corner of sec. 21, T. 14 N., R. 8 W.

A1—0 to 3 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; neutral; clear smooth boundary.

A2—3 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium prismatic parting to moderate medium platy; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very

fine tubular and interstitial pores; neutral; clear smooth boundary.

Bw—6 to 16 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; slightly alkaline; gradual wavy boundary.

Bk1—16 to 25 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic parting to weak coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few distinct lime coats on faces of peds; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—25 to 29 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 60 percent pebbles; continuous faint lime casts on undersides of rock fragments; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

2Bk3—29 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly sand, dark yellowish brown (10YR 4/4 moist); single grain; loose, nonsticky, nonplastic; few very fine roots in upper part; 65 percent pebbles; continuous faint lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to secondary lime: 11 to 27 inches

A horizons
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 25 percent
Reaction: pH 6.6 to 7.3

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 2 to 4 moist
Chroma: 2 to 4
Clay content: 18 to 25 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.4 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 60 percent pebbles
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.4 to 8.4

2Bk3 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 0 to 5 percent
Content of rock fragments: 60 to 70 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

5B—Stady-Wabek complex, 1 to 4 percent slopes

Setting

Landform:
- Stady—Stream terraces
- Wabek—Stream terraces

Slope:
- Stady—1 to 4 percent
- Wabek—1 to 4 percent

Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Stady and similar soils: 70 percent
Wabek and similar soils: 25 percent

Minor Components

Soils that have slopes more than 4 percent: 0 to 2 percent
Very deep loam soils: 0 to 2 percent
Soils with gravelly silt loam surfaces: 0 to 1 percent

Major Component Description

Stady

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Wabek

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

13B—Stady silt loam, cool, 1 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 4 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components

Stady and similar soils: 95 percent

Minor Components

Soils with gravelly loam surface layers: 0 to 2 percent
Very deep loam soils: 0 to 2 percent
Soils with sand and gravel at 15 inches: 0 to 1 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Starley Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Material derived from limestone
Slope range: 15 to 45 percent
Elevation range: 6,000 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryolls

Typical Pedon

Starley channery loam, in an area of Hanson-Starley channery loams, 15 to 45 percent slopes, in an area of rangeland, 1,000 feet south and 500 feet west of the northeast corner of sec. 10, T. 11 N., R. 6 W.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) channery loam, very dark brown (10YR 2/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 30 percent channers; moderately alkaline; clear smooth boundary.

A2—4 to 6 inches; dark grayish brown (10YR 4/2) very channery loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 50 percent channers; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—6 to 18 inches; very pale brown (10YR 7/3) very channery loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 55 percent channers; disseminated lime; continuous prominent lime casts on undersides of rock fragments; violently effervescent; moderately alkaline.

R—18 inches; hard limestone bedrock with few cracks.

Range in Characteristics

Soil temperature: 35 to 45 degrees F
Depth to the lithic contact: 10 to 20 inches
Thickness of the mollic epipedon: 7 to 10 inches

A horizons
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent channers
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam, silt loam, or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 70 percent channers
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

Stemple Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium and material derived from igneous and argillite rock
Slope range: 8 to 60 percent
Elevation range: 5,000 to 7,800 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Typic Palecryalfs

Typical Pedon

Stemple very channery loam, in an area of Stemple-Tigeron very channery loams, 30 to 60 percent slopes, in an area of forestland, 2,500 feet north and 1,300 feet east of the southwest corner of sec. 30, T. 14 N., R. 5 W.

Oi—2 inches to 0; forest litter of partially decomposed needles, twigs, roots, and forbs; abrupt smooth boundary.

E1—0 to 10 inches; light gray (10YR 7/2) very channery loam, light brownish gray (10YR 6/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and few medium roots; 10 percent flagstones and 40 percent channers; strongly acid; clear smooth boundary.

E2—10 to 28 inches; white (2.5Y 8/2) extremely channery loam, light yellowish brown (2.5Y 6/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 10 percent flagstones and 55 percent channers; strongly acid; gradual smooth boundary.

E/Bt—28 to 32 inches; 80 percent white (2.5Y 8/2) extremely channery loam, light yellowish brown (2.5Y 6/4) moist (E part); 20 percent light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist (B part); moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; many silt and sand skeletans on faces of peds; 70 percent channers; moderately acid; gradual smooth boundary.

Bt—32 to 70 inches; pale yellow (2.5Y 7/4) extremely channery clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; few fine and medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; many faint silt and sand skeletans on faces of peds in upper 2 inches of horizon; 10 percent flagstones and 55 percent channers; moderately acid.

Range in Characteristics

Soil temperature: 37 to 42 degrees F
Depth to the argillic horizon: 25 to 50 inches

E1 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 60 percent—10 to 15 percent flagstones; 25 to 45 percent channers
Reaction: pH 5.1 to 6.5

E2 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 80 percent—0 to 20 percent flagstones; 35 to 60 percent channers
Reaction: pH 5.1 to 6.5

E/Bt horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: E part—6 to 8 dry; 4 to 6 moist; B part—5 or 6 dry; 4 or 5 moist
Chroma: E part—2 to 4; B part—4 or 6
Clay content: 15 to 27 percent
Content of rock fragments: 35 to 80 percent—0 to 10 percent flagstones; 35 to 70 percent channers
Reaction: pH 5.1 to 6.5

Bt horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 4 or 6
Clay content: 27 to 35 percent
Content of rock fragments: 60 to 80 percent—10 to 20 percent flagstones; 50 to 60 percent channers
Reaction: pH 5.6 to 6.5

290F—Stemple-Tigeron very channery loams, 30 to 60 percent slopes

Setting

Landform:
- Stemple—Mountains
- Tigeron—Mountains

Slope:
- Stemple—30 to 60 percent
- Tigeron—30 to 60 percent

Elevation: 5,500 to 7,800 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Stemple and similar soils: 70 percent
Tigeron and similar soils: 20 percent

Minor Components
Moderately deep soils: 0 to 4 percent
Soils that have slopes more than 60 percent: 0 to 3 percent
Soils that are calcareous throughout: 0 to 3 percent

Major Component Description

Stemple
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

Tigeron
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

690F—Stemple-Tigeron-Cowood very channery loams, dry, 30 to 60 percent slopes

Setting

Landform:
- Stemple—Mountains
- Tigeron—Mountains
- Cowood—Mountains

Position on landform:
- Stemple—Backslopes and footslopes
- Tigeron—Backslopes and footslopes
- Cowood—Backslopes and shoulders

Slope:
- Stemple—30 to 60 percent
- Tigeron—30 to 60 percent
- Cowood—30 to 60 percent

Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Stemple and similar soils: 40 percent
Tigeron and similar soils: 35 percent
Cowood and similar soils: 15 percent

Minor Components
Cheadle and similar soils: 0 to 3 percent
Very shallow soils: 0 to 3 percent
Areas of rock outcrop: 0 to 2 percent
Deep soils: 0 to 2 percent

Major Component Description

Stemple
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

Tigeron
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.3 inches

Cowood
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

790E—Stemple-Tigeron very channery loams, cool, 8 to 30 percent slopes

Setting

Landform:
- Stemple—Mountains
- Tigeron—Mountains

Slope:
- Stemple—8 to 30 percent
- Tigeron—8 to 30 percent

Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Stemple and similar soils: 70 percent
Tigeron and similar soils: 20 percent

Minor Components
Soils that have slopes more than 30 percent: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Stemple
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

Tigeron
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

790F—Stemple-Tigeron very channery loams, cool, 30 to 60 percent slopes

Setting

Landform:
- Stemple—Mountains
- Tigeron—Mountains

Slope:
- Stemple—30 to 60 percent
- Tigeron—30 to 60 percent

Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Stemple and similar soils: 70 percent
Tigeron and similar soils: 20 percent

Minor Components
Soils that have slopes more than 60 percent: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Stemple
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

Tigeron
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Stryker Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine-silty, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Stryker silt loam, cool, 0 to 2 percent slopes, in an area of forestland, 2,200 feet north and 2,600 feet west of the southeast corner of sec. 23, T. 14 N., R. 9 W.

Oi—2 inches to 0; forest litter of slightly decomposed needles and twigs.

E—0 to 3 inches; pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/2) moist; moderate thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine tubular and interstitial pores; slightly acid; clear smooth boundary.

E/Bt—3 to 7 inches; 60 percent pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/2) moist (E part); 40 percent pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/4) moist (B part); moderate medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; few faint dark brown (7.5YR 5/4) moist clay films on faces of peds; many light gray silt skeletans on faces of peds; slightly acid; clear smooth boundary.

Bt1—7 to 19 inches; pinkish gray (7.5YR 7/2) silty clay loam, brown (7.5YR 5/4) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; common light gray silt skeletans on faces of peds; neutral; clear smooth boundary.

Bt2—19 to 27 inches; pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/4) moist; weak medium

prismatic parting to moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; neutral; gradual wavy boundary.

Bt3—27 to 40 inches; pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/2) moist; few fine distinct strong brown (7.5YR 5/6) moist redox concentrations; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine tubular and interstitial pores; neutral; gradual wavy boundary.

Bk—40 to 48 inches; pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/2) moist; common fine distinct strong brown (7.5YR 5/6) moist redox concentrations; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine tubular and interstitial pores; disseminated lime; common fine seams and soft masses of lime; strongly effervescent; neutral; clear smooth boundary.

2C—48 to 60 inches; light brownish gray (10YR 6/2) very gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky, nonplastic; 50 percent pebbles.

Range in Characteristics

Soil temperature: 41 to 44 degrees F
Depth to the Bk horizon: 20 to 40 inches
Depth to the seasonal high water table: 24 to 42 inches

E horizon
Hue: 7.5YR or 10YR
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Reaction: pH 5.6 to 6.5

E/Bt horizon
Hue: E part—10YR or 7.5YR; B part—10YR or 7.5YR
Value: E part—6 or 7 dry; 5 or 6 moist; B part—6 or 7 dry; 4 to 6 moist
Chroma: E part—2 or 3; B part—2 to 4 moist
Clay content: 18 to 27 percent
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 10YR or 7.5YR
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 to 4
Texture: Silty clay loam or silt loam
Clay content: 25 to 35 percent
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 10YR or 7.5YR
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 18 to 30 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2C horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent stones and cobbles; 35 to 50 percent pebbles
Reaction: pH 7.4 to 8.4

8A—Stryker silt loam, cool, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Stryker and similar soils: 90 percent

Minor Components
Well drained soils: 0 to 7 percent
Soils with sand and gravel at 30 inches: 0 to 2 percent
Poorly drained soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Forestland
Flooding: None
Depth to the seasonal high water table: Apparent, 24 to 42 inches
Available water capacity: Mainly 9.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Swiftcurrent Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Loamy colluvium and alluvium
Slope range: 8 to 65 percent
Elevation range: 4,800 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Eutric Glossocryalfs

Typical Pedon

Swiftcurrent loam, 8 to 35 percent slopes, in an area of forestland, 1,200 feet south and 2,500 feet west of the northeast corner of sec. 30, T. 19 N., R. 8 W.

Oi—2 inches to 0; forest litter of pine needles and twigs.

E—0 to 4 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; moderate thin platy parting to moderate very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and fine and few medium roots; 5 percent pebbles; neutral; clear smooth boundary.

E/Bt—4 to 11 inches; 80 percent very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist (E part); 20 percent pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist (B part); moderate medium prismatic parting to moderate fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine and fine and few medium roots; many very fine tubular and interstitial pores; many silt and sand skeletans on faces of peds; few faint clay films on faces of peds; 5 percent cobbles and 5 percent pebbles; neutral; gradual smooth boundary.

Bt1—11 to 28 inches; pale brown (10YR 6/3) gravelly clay loam, dark yellowish brown (10YR 4/3) moist; moderate medium prismatic parting to moderate medium and coarse subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 5 percent cobbles and 15 percent pebbles; neutral; gradual smooth boundary.

Bt2—28 to 41 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 5 percent cobbles and 15 percent pebbles; slightly alkaline; gradual smooth boundary.

Bk—41 to 60 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots; common very fine interstitial pores; 10 percent cobbles and 20 percent pebbles; disseminated lime; continuous faint lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 37 to 42 degrees F
Depth to the top of the argillic horizon: 8 to 24 inches
Depth to carbonates: 40 to 60 inches

E horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.1 to 7.3

E/Bt horizon
Hue: 5YR, 7.5YR, or 10YR
Value: E part—5 to 7 dry; 4 or 5 moist; B part—4 to 6 dry; 3 to 5 moist
Chroma: E part—2 or 3; B part—3 or 4
Texture: Loam, sandy loam, or sandy clay loam
Clay content: 18 to 35 percent (mixed)
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Clay loam or sandy clay loam
Clay content: 27 to 35 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 7.5YR or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or sandy clay loam
Clay content: 20 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

96E—Swiftcurrent loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Swiftcurrent and similar soils: 90 percent

Minor Components
Tigeron and similar soils: 0 to 3 percent
Mikesell and similar soils: 0 to 3 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Soils with stony surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

96F—Swiftcurrent loam, 35 to 65 percent slopes

Setting

Landform: Mountains
Slope: 35 to 65 percent
Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Swiftcurrent and similar soils: 90 percent

Minor Components
Tigeron and similar soils: 0 to 4 percent
Moderately deep soils: 0 to 3 percent
Soils with stony surface layers: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Thess Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 25 inches and rapid below
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Thess loam, 0 to 2 percent slopes, in an area of rangeland, 300 feet north and 2,400 feet west of the southeast corner of sec. 17, T. 10 N., R. 3 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; few faint lime casts on sides and undersides of pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk1—4 to 20 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; continuous faint lime casts on sides and undersides of pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—20 to 25 inches; light gray (10YR 7/2) gravelly sandy loam, pale brown (10YR 6/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 35 percent pebbles; continuous faint lime casts on sides and undersides of pebbles; common medium soft masses of lime between pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bk3—25 to 32 inches; light brownish gray (2.5Y 6/2) extremely gravelly sand, dark grayish brown (2.5Y 4/2) moist; single grain; nonsticky nonplastic; common very fine roots bunched in upper part; 65 percent pebbles; continuous faint lime casts on undersides of pebbles; common medium soft masses of lime between pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bk4—32 to 60 inches; light brownish gray (2.5Y 6/2) extremely gravelly sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky, nonplastic; 10 percent cobbles and 60 percent pebbles; continuous faint lime casts on undersides of cobbles and pebbles; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the calcic horizon: 3 to 5 inches
Depth to the 2Bk horizon: 20 to 35 inches

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent stones and cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Texture: Loam, silt loam, or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 25 percent—0 to 5 percent stones and cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.4 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Texture: Loam, silt loam, or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent stones and cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.4 to 8.4

2Bk horizons
Hue: 10YR or 2.5Y (colors are variegated)
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 0 to 5 percent
Content of rock fragments: 35 to 85 percent—0 to 20 percent stones and cobbles; 35 to 65 percent pebbles
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.4 to 8.4

209A—Thess loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Thess and similar soils: 90 percent

Minor Components
Scravo and similar soils: 0 to 5 percent
Soils with gravelly loam surface layers: 0 to 5 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

309A—Thess-Scravo complex, 0 to 2 percent slopes

Setting

Landform:
- Thess—Stream terraces
- Scravo—Stream terraces

Slope:
- Thess—0 to 2 percent
- Scravo—0 to 2 percent

Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Thess and similar soils: 50 percent
Scravo and similar soils: 40 percent

Minor Components
Nippt and similar soils: 0 to 5 percent
Soils with cobbly loam surface layers: 0 to 5 percent

Major Component Description

Thess
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

Scravo
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Tigeron Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium derived from argillite and igneous rock
Slope range: 8 to 60 percent
Elevation range: 5,000 to 7,800 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Eutric Haplocryalfs

Typical Pedon

Tigeron very channery loam, in an area of Stemple-Tigeron-Cowood very channery loams, dry, 30 to 60 percent slopes, in an area of forestland, 1,700 feet north and 1,600 feet west of the southeast corner of sec. 11, T. 15 N., R. 7 W.

Oi—2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

E—0 to 11 inches; pinkish gray (7.5YR 7/2) very channery loam, dark brown (7.5YR 4/2) moist; moderate very thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; 35 percent channers; moderately acid; gradual smooth boundary.

E and Bt—11 to 22 inches; 80 percent pinkish gray (7.5YR 7/2) extremely channery loam, dark brown (7.5YR 4/2) moist; moderate fine granular structure (E part); 20 percent light brown (7.5YR 6/4) extremely channery clay loam lamellae $^1/_4$- to $^1/_2$-inch thick, dark brown (7.5YR 4/2) moist (B part); slightly hard, very friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine pores; 60 percent channers; slightly acid; gradual smooth boundary.

Bt—22 to 60 inches; light brown (7.5YR 6/4) extremely channery clay loam, strong brown (7.5YR 5/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 70 percent channers; slightly acid.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the argillic horizon: 13 to 24 inches

E horizon
Hue: 7.5YR or 10YR
Value: 6 to 8 dry; 3 to 6 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 60 percent—0 to 15 percent stones and flagstones; 35 to 45 percent channers
Reaction: pH 5.1 to 6.5

E and Bt horizon
Hue: E part—7.5YR or 10YR; B part—7.5YR or 10YR
Value: E part—6 to 8 dry; 3 to 6 moist; B part—5 or 6 dry; 4 or 5 moist
Chroma: E part—2 or 3; B part—2 to 4 or 6
Texture: E part—sandy loam or loam; B part—sandy loam, loam, clay loam, or sandy clay loam
Clay content: E part—10 to 22 percent; B part—10 to 35 percent
Content of rock fragments: 25 to 70 percent—10 to 25 percent stones and flagstones; 15 to 45 percent channers
Reaction: pH 5.1 to 6.5

Bt horizon
Hue: 7.5YR or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4 or 6
Texture: Sandy loam, sandy clay loam, clay loam, or loam
Clay content: 15 to 35 percent
Content of rock fragments: 60 to 85 percent—20 to 30 percent stones and flagstones; 40 to 55 percent channers
Reaction: pH 5.1 to 6.5

290E—Tigeron very cobbly loam, 15 to 35 percent slopes

Setting

Landform: Mountains
Slope: 15 to 35 percent
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Tigeron and similar soils: 90 percent

Minor Components
Areas of rubble land: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Moderately deep and deep soils: 0 to 2 percent
Soils with stony surface layers: 0 to 2 percent
Soils that are calcareous throughout: 0 to 2 percent

Major Component Description

Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

890F—Tigeron very gravelly loam, cool, 35 to 60 percent slopes

Setting

Landform: Mountains
Slope: 35 to 60 percent
Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 20 to 28 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Tigeron and similar soils: 90 percent

Minor Components
Soils that have slopes less than 35 percent: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Tolex Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Material derived from argillite and igneous bedrock
Slope range: 8 to 80 percent
Elevation range: 3,500 to 6,000 feet
Mean annual precipitation: 12 to 25 inches
Frost-free period: 70 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Haplustalfs

Typical Pedon

Tolex channery loam, 8 to 35 percent slopes, in an area of forestland, 2,100 feet south and 200 feet east of the northwest corner of sec. 34, T. 12 N., R. 3 W.

Oi—1 inch to 0; forest litter of partially decomposed needles, twigs, and roots; clear smooth boundary.
A—0 to 1 inch; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, nonplastic; common very fine and fine roots; many very fine interstitial pores; 20 percent channers; moderately acid; clear smooth boundary.
E—1 to 5 inches; very pale brown (10YR 7/3) channery loam, yellowish brown (10YR 5/4) moist; moderate very thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine interstitial pores; 20 percent channers; moderately acid; clear smooth boundary.
Bt—5 to 13 inches; light yellowish brown (10YR 6/4) extremely channery clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds and on coarse rock fragments; 65 percent channers; slightly acid; gradual smooth boundary.
BC—13 to 18 inches; brownish yellow (10YR 6/6) extremely channery loam, yellowish brown (10YR 5/6) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; 5 percent flagstones and 85 percent channers; slightly effervescent on undersides of coarse rock fragments; neutral.
R—18 inches; hard argillite bedrock with few cracks; few fine roots in some cracks.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to bedrock: 10 to 20 inches

A horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent

Content of rock fragments: 15 to 60 percent—0 to 20 percent stones and flagstones; 15 to 40 percent channers
Reaction: pH 5.6 to 6.5

E horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 75 percent—0 to 15 percent flagstones; 15 to 60 percent channers
Reaction: pH 5.6 to 6.5

Bt horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 3, 4, or 6
Texture: Clay loam or sandy clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 60 to 80 percent—0 to 10 percent flagstones; 60 to 70 percent channers
Reaction: pH 5.6 to 6.5

BC horizon
Hue: 5YR, 7.5YR, or 10YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 3, 4, or 6
Clay content: 10 to 25 percent
Content of rock fragments: 60 to 90 percent—0 to 10 percent flagstones; 55 to 85 percent channers
Reaction: pH 6.6 to 7.8

25F—Tolex-Mocmont-Rock outcrop complex, cool, 25 to 60 percent slopes

Setting

Landform:
- Tolex—Mountains
- Mocmont—Mountains

Position on landform:
- Tolex—Backslopes and shoulders
- Mocmont—Footslopes
- Rock outcrop—Shoulders

Slope:
- Tolex—25 to 60 percent
- Mocmont—25 to 60 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Tolex and similar soils: 45 percent
Mocmont and similar soils: 35 percent
Rock outcrop: 15 percent

Minor Components
Castner and similar soils: 0 to 2 percent
Holter and similar soils: 0 to 2 percent
Soils with stony surface layers: 0 to 1 percent

Major Component Description

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Rock outcrop
Definition: Hard argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

563E—Tolex-Tolman-Hauz channery loams, 8 to 45 percent slopes

Setting

Landform:
- Tolex—Mountains
- Tolman—Mountains
- Hauz—Mountains

Position on landform:
- Tolex—Backslopes and shoulders
- Tolman—Backslopes and shoulders
- Hauz—Backslopes

Slope:
- Tolex—8 to 45 percent
- Tolman—8 to 45 percent
- Hauz—8 to 45 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Tolex and similar soils: 40 percent
Tolman and similar soils: 35 percent
Hauz and similar soils: 20 percent

Minor Components
Sieben and similar soils: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Soils that have slopes more than 45 percent: 0 to 1 percent

Major Component Description

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

Tolman
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.8 inches

Hauz
Surface layer texture: Channery loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

663E—Tolex channery loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Tolex and similar soils: 90 percent

Minor Components
Tolman and similar soils: 0 to 2 percent
Whitecow and similar soils: 0 to 2 percent
Mocmont and similar soils: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Very shallow soils: 0 to 2 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

763E—Tolex-Holter-Castner channery loams, 8 to 45 percent slopes

Setting

Landform:
- Tolex—Mountains
- Holter—Mountains
- Castner—Mountains

Position on landform:
- Tolex—Backslopes and shoulders
- Holter—Footslopes
- Castner—Backslopes and shoulders

Slope:
- Tolex—8 to 45 percent
- Holter—8 to 45 percent
- Castner—8 to 45 percent

Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Tolex and similar soils: 40 percent
Holter and similar soils: 30 percent
Castner and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 4 percent
Soils that have slopes more than 45 percent: 0 to 3 percent
Deep loamy soils with trees: 0 to 3 percent

Major Component Description

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

Holter
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

963F—Tolex-Mocmont-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform:
- Tolex—Mountains
- Mocmont—Mountains

Position on landform:
- Tolex—Backslopes and shoulders
- Mocmont—Footslopes
- Rock outcrop—Shoulders

Slope:
- Tolex—25 to 60 percent
- Mocmont—25 to 60 percent

Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Tolex and similar soils: 45 percent
Mocmont and similar soils: 35 percent
Rock outcrop: 15 percent

Minor Components
Holter and similar soils: 0 to 2 percent
Soils that have slopes more than 60 percent: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland

Flooding: None
Available water capacity: Mainly 1.3 inches

Mocmont
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.3 inches

Rock outcrop
Definition: Hard argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Tolman Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountains
Parent material: Material derived from argillite and igneous bedrock
Slope range: 4 to 60 percent
Elevation range: 3,500 to 5,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Argiustolls

Typical Pedon

Tolman channery loam, in an area of Hauz-Sieben-Tolman channery loams, 8 to 45 percent slopes, in an area of rangeland, 1,040 feet south and 2,000 feet east of the northwest corner of sec. 3, T. 12 N., R. 5 W.

A—0 to 5 inches; brown (7.5YR 5/2) channery loam, dark brown (7.5YR 3/2) moist; moderate very thin platy parting to moderate very fine granular structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; 20 percent channers; slightly acid; clear smooth boundary.

Bt—5 to 10 inches; light brown (7.5YR 6/4) very channery clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; many very fine roots; many very fine tubular and interstitial pores; many distinct clay films on faces of peds; 50 percent channers; neutral; gradual smooth boundary.

BC—10 to 19 inches; light brown (7.5YR 6/4) very channery loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; 10 percent flagstones and 50 percent channers; neutral; gradual smooth boundary.

R—19 inches; fractured bedrock; few fine roots extending into vertical cracks; few thin lime coats on undersides of some rock fragments.

Range in Characteristics

Soil temperature: 39 to 44 degrees F
Depth to the lithic contact: 10 to 20 inches

A horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or sandy clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 35 percent channers
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 to 6 dry; 2 to 4 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent flagstones; 35 to 50 percent channers
Reaction: pH 6.1 to 7.8

BC horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 to 6 dry; 2 to 4 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent flagstones; 35 to 50 percent channers
Reaction: pH 6.1 to 7.8

363F—Tolman-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform: Mountains
Slope: 15 to 60 percent
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Tolman and similar soils: 65 percent
Rock outcrop: 25 percent

Minor Components
Mocmont and similar soils: 0 to 2 percent
Hauz and similar soils: 0 to 2 percent
Sieben and similar soils: 0 to 2 percent
Very shallow soils: 0 to 2 percent
Soils that have slopes more than 60 percent: 0 to 2 percent

Major Component Description

Tolman
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.8 inches

Rock outcrop
Definition: Hard argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Totelake Series

Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Permeability: Moderate to a depth of 11 inches and rapid below
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 3 percent
Elevation range: 4,400 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Typic Haplustepts

Typical Pedon

Totelake gravelly loam, 0 to 3 percent slopes, in an area of forestland, 1,400 feet north and 100 feet west of the southeast corner of sec. 16, T. 14 N., R. 8 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter of needles and twigs.
A—0 to 4 inches; pinkish gray (7.5YR 6/2) gravelly loam, dark brown (7.5YR 4/2) moist; moderate very thin platy parting to moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few coarse roots; many light gray silt and sand skeletans of faces of peds; 20 percent pebbles; slightly alkaline; clear smooth boundary.
Bw—4 to 11 inches; pinkish gray (7.5YR 6/2) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; 15 percent cobbles and 40 percent pebbles; few distinct lime coats on undersides of coarse rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.
2C—11 to 60 inches; pinkish gray (7.5YR 6/2) extremely cobbly sand, dark brown (7.5YR 4/2) moist; single grain; loose, nonsticky, nonplastic; common fine and few medium roots to 24 inches and few fine and medium roots below; 25 percent cobbles and 45 percent pebbles; common distinct lime coats on undersides of rock fragments; disseminated lime; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F

A horizon
Value: 4 to 6 dry; 2 to 4 moist
Chroma: 1 to 3
Clay content: 8 to 15 percent
Content of rock fragments: 15 to 35 percent—0 to 15 percent stones and cobbles; 15 to 20 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4
Clay content: 5 to 10 percent
Content of rock fragments: 35 to 60 percent—0 to 15 percent stones and cobbles; 35 to 45 percent pebbles
Reaction: pH 6.6 to 7.8

2C horizon
Hue: 10YR or 7.5YR
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loamy sand or sand
Clay content: 0 to 10 percent
Content of rock fragments: 60 to 80 percent—15 to 25 percent stones and cobbles; 45 to 55 percent pebbles
Reaction: pH 6.6 to 7.8

6A—Totelake gravelly loam, 0 to 3 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 3 percent
Elevation: 4,400 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Totelake and similar soils: 95 percent

Minor Components
Very poorly drained soils: 0 to 2 percent
Poorly drained soils: 0 to 1 percent
Soils that have slopes more than 3 percent: 0 to 1 percent
Soils with very cobbly loam surface layer: 0 to 1 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Alluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 2.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Trapps Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Mountains
Parent material: Colluvium derived from limestone and argillite rock or alpine till
Slope range: 8 to 60 percent
Elevation range: 4,500 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 70 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Trapps channery loam, 25 to 60 percent slopes, in an area of forestland, 1,000 feet south and 1,500 feet east of the northwest corner of sec. 28, T. 16 N., R. 6 W.

Oi—1 inch to 0; forest litter of partially decomposed needles and twigs.
E—0 to 4 inches; pink (7.5YR 7/4) channery loam, brown (7.5YR 5/4) moist; moderate very thin platy parting to moderate very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine roots; 25 percent channers; slightly alkaline; clear smooth boundary.
Bt—4 to 20 inches; reddish yellow (7.5YR 6/6) very channery clay loam, strong brown (7.5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; 40 percent channers; slightly alkaline; gradual smooth boundary.
Bk1—20 to 40 inches; pink (7.5YR 7/4) very channery loam, strong brown (7.5YR 5/6) moist; moderate very fine and fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 20 percent flagstones and

40 percent channers; disseminated lime; continuous prominent lime casts on undersides of coarse rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—40 to 60 inches; pink (7.5YR 7/4) extremely channery loam, brown (7.5YR 5/4) moist; moderate very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine tubular and interstitial pores; 20 percent flagstones and 50 percent channers; disseminated lime; continuous prominent lime casts on undersides of coarse rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Bk horizon: 15 to 35 inches

E horizon
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 to 4
Clay content: 10 to 15 percent
Content of rock fragments: 15 to 35 percent—0 to 20 percent stones, flagstones, or cobbles; 15 to 25 percent pebbles or channers
Reaction: pH 5.6 to 7.3

Bt horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 to 4 or 6
Clay content: 27 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent flagstones or cobbles; 35 to 50 percent pebbles or channers
Reaction: pH 6.6 to 8.4

Bk1 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 to 4, 6, or 8
Texture: Loam or sandy loam
Clay content: 10 to 15 percent
Content of rock fragments: 35 to 60 percent—0 to 20 percent stones, flagstones, or cobbles; 35 to 40 percent pebbles or channers
Calcium carbonate equivalent: 20 to 40 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 to 4, 6, or 8
Texture: Loam or sandy loam
Clay content: 10 to 15 percent
Content of rock fragments: 45 to 85 percent—10 to 30 percent stones, flagstones, or cobbles; 50 to 55 percent pebbles or channers
Calcium carbonate equivalent: 20 to 30 percent
Reaction: pH 7.9 to 8.4

484F—Trapps channery loam, 25 to 60 percent slopes

Setting

Landform: Mountains
Slope: 25 to 60 percent
Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 18 to 25 inches
Frost-free period: 80 to 105 days

Composition

Major Components
Trapps and similar soils: 90 percent

Minor Components
Whitecow and similar soil: 0 to 3 percent
Areas of rock outcrop: 0 to 3 percent
Moderately deep soils: 0 to 2 percent
Shallow soils: 0 to 2 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

584D—Trapps stony loam, 8 to 25 percent slopes

Setting

Landform: Mountains
Slope: 8 to 25 percent
Elevation: 4,600 to 5,000 feet
Mean annual precipitation: 18 to 25 inches
Frost-free period: 70 to 100 days

Composition

Major Components
Trapps and similar soils: 95 percent

Minor Components
Soils that have slopes more than 25 percent: 0 to 2 percent
Moderately deep soils: 0 to 1 percent
Soils with no lime: 0 to 1 percent
Soils with less rock fragments: 0 to 1 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

984F—Trapps-Warneke channery loams, 25 to 60 percent slopes

Setting

Landform:
- Trapps—Mountains
- Warneke—Mountains

Position on landform:
- Trapps—Backslopes and footslopes
- Warneke—Backslopes and shoulders

Slope:
- Trapps—25 to 60 percent
- Warneke—25 to 60 percent

Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 18 to 25 inches
Frost-free period: 80 to 100 days

Composition

Major Components
Trapps and similar soils: 70 percent
Warneke and similar soils: 25 percent

Minor Components
Whitecow and similar soils: 0 to 2 percent
Soils that have slopes more than 60 percent: 0 to 1 percent
Very shallow soils: 0 to 1 percent
Noncalcareous shallow soils: 0 to 1 percent

Major Component Description

Trapps
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

Warneke
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

985F—Trapps-Whitecow-Warneke channery loams, 25 to 60 percent slopes

Setting

Landform:
- Trapps—Mountains
- Whitecow—Mountains
- Warneke—Mountains

Position on landform:
- Trapps—Backslopes and footslopes
- Whitecow—Backslopes and footslopes
- Warneke—Backslopes and shoulders

Slope:
- Trapps—25 to 60 percent
- Whitecow—25 to 60 percent
- Warneke—25 to 60 percent

Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 18 to 25 inches
Frost-free period: 80 to 100 days

Composition

Major Components
Trapps and similar soils: 40 percent
Whitecow and similar soils: 35 percent
Warneke and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 1 percent
Very shallow soils: 0 to 1 percent
Noncalcareous shallow soils: 0 to 1 percent
Moderately deep soils: 0 to 1 percent
Soils with grass vegetation: 0 to 1 percent

Major Component Description

Trapps
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

Whitecow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Warneke
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Tropal Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Material derived from limestone
Slope range: 25 to 60 percent
Elevation range: 5,000 to 7,500 feet
Mean annual precipitation: 19 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, carbonatic Lithic Eutrocryepts

Typical Pedon

Tropal very gravelly loam, in an area of Tropal-Rock outcrop complex, 25 to 60 percent slopes, in an area of rangeland, 2,400 feet south and 800 feet east of the northwest corner of sec. 31, T. 19 N., R. 7 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; 15 percent angular cobbles and 40 percent angular pebbles; slightly alkaline; clear smooth boundary.
Bw—4 to 13 inches; brown (10YR 5/3) extremely gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky parting to weak fine and medium granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; many very fine tubular and interstitial pores; 70 percent angular pebbles; continuous faint lime coats on undersides of pebbles in lower part; slightly alkaline; clear smooth boundary.
Bk—13 to 19 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 5/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; common very fine roots; many very fine tubular and interstitial pores; 10 percent angular cobbles and 60 percent angular pebbles; continuous faint lime casts on undersides of pebbles; disseminated lime; violently effervescent; slightly alkaline; clear smooth boundary.
R—19 inches; hard limestone bedrock with few cracks; few fine roots in some cracks.

Range in Characteristics

Soil temperature: 38 to 42 degrees F
Depth to bedrock: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent

Content of rock fragments: 35 to 60 percent—0 to 15 percent stones and cobbles; 35 to 45 percent pebbles
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 80 percent
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 80 percent—10 to 20 percent stones and cobbles; 25 to 60 percent pebbles
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.4 to 8.4

177F—Tropal-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform: Mountains
Position on landform:
- Tropal—Backslopes
- Rock outcrop—Shoulders

Slope: 25 to 60 percent
Elevation: 5,000 to 7,500 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Tropal and similar soils: 65 percent
Rock outcrop: 25 percent

Minor Components
Whitore and similar soils: 0 to 4 percent
Soils that have slopes more than 60 percent: 0 to 3 percent
Moderately deep soils: 0 to 3 percent

Major Component Description

Tropal
Surface layer texture: Very gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.1 inches

Rock outcrop
Definition: Limestone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Turrah Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Slow
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Fine, mixed, superactive, frigid Cumulic Endoaquolls

Typical Pedon

Turrah silty clay, 0 to 2 percent slopes, in an area of irrigated pasture, 900 feet south and 1,100 feet west of the northeast corner of sec. 34, T. 14 N., R. 9 W.

Oi—3 inches to 0; slightly decomposed organic layer of plant roots.

A1—0 to 3 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; many very fine roots; slightly acid; clear smooth boundary.

A2—3 to 15 inches; black (5Y 2.5/1) silty clay, dark gray (5Y 4/1) dry; moderate medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; slightly acid; clear smooth boundary.

Bg1—15 to 20 inches; very dark gray (5Y 3/1) silty clay loam, gray (5Y 5/1) dry; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and

interstitial pores; slightly acid; clear smooth boundary.

Bg2—20 to 31 inches; black (5Y 2.5/1) silty clay, dark gray (5Y 4/1) dry; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; slightly acid; gradual smooth boundary.

Bg3—31 to 39 inches; gray (5Y 5/1) clay, gray (5Y 6/1) dry; common fine and medium prominent strong brown (7.5YR 5/6) moist redox concentrations; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; slightly acid; clear smooth boundary.

2Cg—39 to 60 inches; dark grayish brown (2.5Y 4/2) extremely cobbly sandy loam, light brownish gray (2.5Y 6/2) dry; massive; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots; 35 percent cobbles and 35 percent pebbles; slightly acid.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 24 to 48 inches
Depth to the seasonal high water table: 12 to 24 inches

A1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 2, 2.5, or 3 moist; 2 to 4 dry
Chroma: 1 or 2
Clay content: 40 to 60 percent
Reaction: pH 5.6 to 7.3

A2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 2, 2.5, or 3 moist; 2 to 4 dry
Chroma: 1 or 2
Texture: Clay, silty clay loam, or silty clay
Clay content: 40 to 60 percent
Reaction: pH 5.6 to 7.3

Bg horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 2, 2.5, 3 to 5 moist; 4 to 6 dry
Chroma: 0 to 3
Redox concentrations: 10YR 4/4, 10YR 4/6, 10YR 5/6, 10YR 6/4, 10YR 6/6, or 7.5YR 5/6
Texture: Clay, silty clay, silty clay loam, or clay loam
Clay content: 35 to 60 percent
Reaction: pH 6.6 to 7.8

2Cg horizon
Hue: 2.5Y or 5Y
Value: 4 or 5 moist; 4 to 6 dry
Chroma: 1 or 2
Texture: Sandy clay loam, sandy loam, or clay loam
Clay content: 20 to 40 percent
Content of rock fragments: 35 to 85 percent—15 to 35 percent cobbles; 20 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

417A—Turrah silty clay, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Composition

Major Components
Turrah and similar soils: 90 percent

Minor Components
Very poorly drained soils: 0 to 5 percent
Soils with sand and gravel at 30 inches: 0 to 2 percent
Somewhat poorly drained soils: 0 to 2 percent
Soils with silty clay loam surface layers: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 12 to 24 inches
Available water capacity: Mainly 7.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Typic Haplustepts

Depth class: Deep (40 to 60 inches) or very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium derived from argillite
Slope range: 25 to 60 percent
Elevation range: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Typic Haplustepts

Typical Pedon

Fine-loamy, mixed Typic Ustochrepts in an area of Typic Haplustepts-Tolex complex, 25 to 60 percent slopes, in an area of forestland, 1,100 feet north and 1,000 feet west of the southeast corner of sec. 29, T. 18 N., R. 6 W.

O—1 inch to 0; forest litter of partially decomposed needles, twigs, and leaves.
A1—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to moderate very fine granular structure; soft, very friable, moderately sticky, slightly plastic; many very fine and fine and few medium roots; slightly alkaline; clear smooth boundary.
Bw1—6 to 25 inches; light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) moist; weak coarse prismatic parting to weak coarse angular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; slightly alkaline; gradual smooth boundary.
Bw2—25 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 1 percent pebbles; few faint lime casts on undersides of pebbles; slightly alkaline.

Range in Characteristics

Depth to bedrock or hard shale: 40 inches or more
Content of rock fragments in the control section: 0 to 35 percent cobbles and pebbles

195F—Typic Haplustepts-Tolex complex, 25 to 60 percent slopes

Setting

Landform:
- Typic Ustochrepts—Mountains
- Tolex—Mountains

Position on landform:
- Typic Ustochrepts—Backslopes and footslopes
- Tolex—Backslopes and shoulders

Slope:
- Typic Ustochrepts—25 to 60 percent
- Tolex—25 to 60 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Typic Haplustepts and similar soils: 70 percent
Tolex and similar soils: 15 percent

Minor Components
Soils that are clayey textured: 0 to 4 percent
Soils that have slopes more than 60 percent: 0 to 4 percent
Moderately deep soils: 0 to 4 percent
Soils with darker colored surface layers: 0 to 3 percent

Major Component Description

Typic Haplustepts
Surface layer texture: Loam
Drainage class: Well drained
Dominant parent material: Argillite colluvium
Native plant cover type: Forestland
Flooding: None

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Typic Ustifluvents

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained or moderately well drained
Permeability: Variable
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 3,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days
Flooding: Rare to occasional

Taxonomic Class: Typic Ustifluvents

Typical Pedon

Typic Ustifluvents, in an area of Typic Ustifluvents-Fluvaquentic Haplustolls complex, 0 to 4 percent slopes, in an area of cropland, 2,000 feet north and 100 feet west of the southeast corner of sec. 2, T. 17 N., R. 4 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1—6 to 28 inches; light brownish gray (2.5Y 6/2) loam with thin strata of silt loam and sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—28 to 31 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, slightly sticky, nonplastic; common very fine roots; common very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

2C3—31 to 60 inches; light brownish gray (2.5Y 6/2) extremely gravelly sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky, nonplastic; strongly effervescent; mildly alkaline.

Range in Characteristics

Ap horizon
Texture: Loam or clay loam
Content of rock fragments: 0 to 35 percent pebbles

C1 horizon
Texture: Loam, clay loam, or gravelly sandy loam to a depth of 20 inches and loam to extremely gravelly sand below

C2 and 2C3 horizons
Texture: Loam, clay loam, or gravelly sandy loam to a depth of 20 inches and loam to extremely gravelly sand below

301B—Typic Ustifluvents, 0 to 4 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 4 percent
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Typic Ustifluvents and similar soils: 90 percent

Minor Components
Somewhat poorly drained soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent
Very deep loamy soils: 0 to 3 percent
Soils with less rock fragments: 0 to 1 percent

Major Component Description

Dominant parent material: Alluvium
Flooding: Occasional

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

601B—Typic Ustifluvents-Fluvaquentic Haplustolls complex, 0 to 4 percent slopes

Setting

Landform:
- Typic Ustifluvents—Flood plains
- Fluvaquentic Haplustolls—Flood plains

Slope:
- Typic Ustifluvents—0 to 4 percent
- Fluvaquentic Haplustolls—0 to 4 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Typic Ustifluvents and similar soils: 50 percent
Fluvaquentic Haplustolls and similar soils: 40 percent

Minor Components
Soils that have slopes more than 4 percent: 0 to 5 percent
Poorly drained soils: 0 to 5 percent

Major Component Description

Typic Ustifluvents
Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional

Fluvaquentic Haplustolls
Depth class: Very deep (more than 60 inches)
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Vanda Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 0 to 3 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, smectitic, calcareous, frigid Torrertic Ustorthents

Typical Pedon

Vanda silty clay, 0 to 3 percent slopes, in an area of rangeland, 2,400 feet south and 2,400 feet east of the northwest corner of sec. 21, T. 21 N., R. 7 W.

A1—0 to 1 inch; light gray (5Y 7/1) silty clay, gray (5Y 5/1) moist; thin massive crust that has fine granules on undersides; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine and fine vesicular pores; 10 percent pebbles; disseminated lime; strongly effervescent; strongly alkaline; abrupt smooth boundary.

A2—1 to 2 inches; gray (5Y 6/1) silty clay, gray (5Y 5/1) moist; weak very fine and fine granular structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; strongly alkaline; clear smooth boundary.

Bw—2 to 6 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; weak medium angular blocky parting to weak thin platy structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; strongly alkaline; clear smooth boundary.

By—6 to 30 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine roots; common very fine tubular and interstitial pores; common fine seams and masses of gypsum; common fine and medium dead roots; disseminated lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

Byz—30 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine tubular and interstitial pores; common fine and medium seams and masses of gypsum and other salts; disseminated lime; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A and Bw horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 1 to 3
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 20 to 30
Reaction: pH 7.8 to 9.6

By horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 60 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.8 to 9.6

Byz horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 60 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Gypsum content: 1 to 5 percent
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.8 to 9.6

505A—Vanda silty clay, 0 to 3 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 3 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Vanda and similar soils: 90 percent

Minor Components
Very strongly saline soils: 0 to 5 percent
Somewhat poorly drained soils: 0 to 5 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Vebar Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Sedimentary plains
Parent material: Material derived from semiconsolidated sandstone
Slope range: 2 to 8 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Typic Haplustolls

Typical Pedon

Vebar fine sandy loam, in an area of Vebar-Cuniff fine sandy loams, 2 to 8 percent slopes, in an area of rangeland, 1,500 feet north and 2,400 feet east of the southwest corner of sec. 15, T. 19 N., R. 7 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine roots; slightly alkaline; clear smooth boundary.

A2—6 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, nonplastic; many very fine roots; many very fine tubular and interstitial pores; slightly alkaline; gradual smooth boundary.

Bw—10 to 17 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; many very fine tubular and interstitial pores; slightly alkaline; gradual smooth boundary.

BC—17 to 28 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse angular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; few distinct lime coats on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

Cr—28 to 60 inches; light olive gray (5Y 6/2) semiconsolidated sandy sedimentary beds, olive gray (5Y 5/2) moist; strongly effervescent.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to the paralithic contact: 20 to 40 inches

A horizons
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 10 to 18 percent
Reaction: pH 6.1 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Fine sandy loam, sandy loam, or loam
Clay content: 10 to 18 percent
Reaction: pH 6.1 to 8.4

BC horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy loam, fine sandy loam, loamy fine sand, or fine sand
Clay content: 7 to 15 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 6.1 to 8.4

239C—Vebar-Cuniff fine sandy loams, 2 to 8 percent slopes

Setting

Landform:
- Vebar—Sedimentary plains
- Cuniff—Sedimentary plains

Position on landform:
- Vebar—Backslopes and footslopes
- Cuniff—Shoulders

Slope:
- Vebar—2 to 8 percent
- Cuniff—2 to 8 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Vebar and similar soils: 65 percent
Cuniff and similar soils: 30 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Soils with loam textures: 0 to 2 percent
Areas of blowouts: 0 to 1 percent

Major Component Description

Vebar
Surface layer texture: Fine sandy loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

Cuniff
Surface layer texture: Fine sandy loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Villard Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Moderately slow to a depth of 30 inches and rapid below
Landform: Flood plains

Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 3,600 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid Typic Endoaquepts

Typical Pedon

Villard silt loam, in an area of Villard-Villy silt loams, 0 to 2 percent slopes, in an area of pasture, 700 feet south and 2,100 feet east of the northwest corner of sec. 10, T. 10 N., R. 3 W.

Oi—2 inches to 0; undecomposed and slightly decomposed layer of fibric material; slightly effervescent; mildly alkaline; clear smooth boundary.

Ag—0 to 3 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; common fine prominent dark brown (7.5YR 4/4) mottles moist; moderate thin platy structure; hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; many very fine tubular and interstitial pores; 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bg1—3 to 8 inches; dark gray (10YR 4/1) silty clay loam, gray (10YR 6/1) dry; common fine prominent dark brown (7.5YR 4/4) moist redox concentrations; weak thin platy structure; hard, friable, moderately sticky, moderately plastic; many very fine roots; common very fine tubular and interstitial pores; slightly effervescent; neutral; clear smooth boundary.

Bg2—8 to 19 inches; olive gray (5Y 5/2) silty clay loam, light gray (5Y 7/2) dry; many fine and medium prominent brownish yellow (10YR 4/6) moist redox concentrations; weak thin platy structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; common very fine tubular and interstitial pores; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bg3—19 to 30 inches; gray (5Y 5/1) loam, gray (5Y 6/1) dry; many fine and medium prominent strong brown (7.5YR 5/6) moist redox concentrations; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; neutral; clear smooth boundary.

2C—30 to 60 inches; dark brown (10YR 4/3) very gravelly sand, yellow (10YR 7/6) dry; single grain; loose, nonsticky, nonplastic; 55 percent pebbles; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the 2C horizon: 20 to 40 inches
Depth to the seasonal high water table: 12 to 24 inches

Ag horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist; 5 or 6 dry
Chroma: 1 or 2
Clay content: 20 to 27 percent
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 8.4

Bg1 and Bg2 horizons
Hue: 10YR, 2.5Y, or 5Y; redox concentrations: 7.5YR or 10YR
Value: 4 or 5 moist; 6 or 7 dry
Chroma: 1 or 2; redox concentrations: 4 or 6
Clay content: 27 to 35 percent
Effervescence: Slightly or strongly
Reaction: pH 6.6 to 8.4

Bg3 horizon
Hue: 2.5Y or 5Y; redox concentrations: 7.5YR or 10YR
Value: 4 or 5 moist; 5 or 6 dry
Chroma: 1 or 2; redox concentrations: 4 or 6
Texture: Loam or silt loam
Clay content: 15 to 27 percent
Reaction: pH 6.6 to 7.3

2C horizon
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 50 to 80 percent—0 to 5 percent cobbles; 50 to 75 percent pebbles
Reaction: pH 6.6 to 7.3

408A—Villard-Villy silt loams, 0 to 2 percent slopes

Setting

Landform:
- Villard—Flood plains
- Villy—Flood plains

Slope:
- Villard—0 to 2 percent
- Villy—0 to 2 percent

Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Villard and similar soils: 70 percent
Villy and similar soils: 20 percent

Minor Components
Very poorly drained soils: 0 to 5 percent
Moderately well drained soils: 0 to 3 percent
Soils that are shallow to sand and gravel: 0 to 2 percent

Major Component Description

Villard
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 12 to 24 inches
Available water capacity: Mainly 6.2 inches

Villy
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 0 to 24 inches
Available water capacity: Mainly 11.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Villy Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Alluvium
•*Slope range:* 0 to 2 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-silty, mixed, superactive, calcareous, frigid Typic Fluvaquents

Typical Pedon

Villy silty clay loam, 0 to 2 percent slopes, in an area of pasture, 400 feet south and 1,600 feet east of the northwest corner of sec. 8, T. 6 N., R. 2 E. (Broadwater County, Montana)

Oi—2 inches to 0; root mat consisting of many live fibrous roots; abrupt smooth boundary.

A—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, light gray (10YR 6/2) dry; moderate thin platy structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline (pH 8.4); clear smooth boundary.

Cg1—7 to 22 inches; gray (N 5/) silty clay loam, light gray (N 7/) dry; massive; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline (pH 8.4); clear smooth boundary.

Cg2—22 to 34 inches; dark gray (N 4/) silty clay loam, gray (N 6/) dry; massive; hard, friable, moderately sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline (pH 8.3); gradual smooth boundary.

2Abg—34 to 40 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; disseminated lime; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

2Cbg—40 to 60 inches; gray (5Y 5/1) silty clay loam, light gray (5Y 7/1) dry; massive; hard, friable, moderately sticky, slightly plastic; disseminated lime; strongly effervescent; moderately alkaline (pH 8.2).

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the seasonal high water table: 0 to 24 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 5 moist; 5 to 7 dry
Chroma: 1 or 2
Texture: Silt loam or silty clay loam

Clay content: 18 to 35 percent
Reaction: pH 7.9 to 8.4

Cg and 2Cbg horizons
Hue: 10YR, 2.5Y, 5Y, or N
Value: 4 to 6 moist; 6 to 8 dry
Chroma: 0 to 2
Texture: Silt loam, silty clay loam, or very fine sandy loam
Clay content: 18 to 35 percent
Redox features: 7.5YR 4/2, 4/4 or 5Y 4/2, 4/3
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

2Abg horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist; 4 or 5 dry
Chroma: 0 to 3
Texture: Silt loam or silty clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

308A—Villy silt loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Villy and similar soils: 95 percent

Minor Components
Fairway and similar soils: 0 to 2 percent
Very poorly drained soils: 0 to 2 percent
Soils deep to sand and gravel: 0 to 1 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Depth to the seasonal high water table: Apparent, 0 to 24 inches
Available water capacity: Mainly 11.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

808A—Villy silt loam, 0 to 2 percent slopes, very rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,600 to 4,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Villy and similar soils: 95 percent

Minor Components
Villy undrained soils: 0 to 3 percent
Soils with sand and gravel at 40 inches: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Very rare
Depth to the seasonal high water table: Apparent, 0 to 24 inches
Available water capacity: Mainly 11.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Wabek Series

Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained

Permeability: Moderate to a depth of 10 inches and rapid below
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,500 to 4,800 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 80 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Entic Haplustolls

Typical Pedon

Wabek very gravelly loam, in an area of Stady-Wabek complex, 1 to 4 percent slopes, in an area of rangeland, 2,000 feet north and 50 feet east of the southwest corner of sec. 22, T. 14 N., R. 9 W.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) very gravelly loam, black (10YR 2/1) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 50 percent pebbles; neutral; clear smooth boundary.

A2—2 to 10 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 55 percent pebbles; neutral; clear smooth boundary.

A3—10 to 15 inches; dark grayish brown (10YR 4/2) extremely gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; loose, nonsticky, nonplastic; common very fine roots; 5 percent cobbles and 55 percent pebbles; neutral; clear smooth boundary.

Bk—15 to 45 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; loose, nonsticky, nonplastic; common very fine roots to 22 inches and few below 22 inches; 75 percent pebbles; common distinct lime casts on undersides of rock fragments; slightly effervescent; neutral; gradual smooth boundary.

C—45 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; loose, nonsticky, nonplastic; few very fine roots; 75 percent pebbles; slightly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F

A horizons
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 10 to 20 percent
Content of rock fragments: 15 to 60 percent—0 to 5 percent cobbles; 15 to 55 percent pebbles
Reaction: pH 6.6 to 9.0

Bk horizon
Hue: 10YR or 2.5Y
Value: 4 to 8 dry; 2 to 6 moist
Chroma: 2 to 4
Texture: Sand, loamy coarse sand, coarse sandy loam, sandy loam, loamy sand, or loam
Clay content: 0 to 3 percent
Content of rock fragments: 35 to 75 percent pebbles
Reaction: pH 7.4 to 9.0

C horizon
Hue: 10YR or 2.5Y
Value: 4 to 7 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Sand, coarse sand, loamy coarse sand, or loamy sand
Clay content: 0 to 3 percent
Content of rock fragments: 35 to 75 percent pebbles
Reaction: pH 7.4 to 9.0

Warneke Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountains
Parent material: Material derived from limestone
Slope range: 15 to 60 percent
Elevation range: 4,000 to 6,000 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 80 to 110 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Lithic Calciustepts

Typical Pedon

Warneke gravelly loam, in an area of Warneke-Rock outcrop complex, 15 to 60 percent slopes, in an area of forestland, 2,500 feet north and 1,000 feet west of the southeast corner of sec. 31, T. 11 N., R. 5 W.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist;

weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and few medium roots; 20 percent angular pebbles; slightly alkaline; clear smooth boundary.

Bk1—4 to 10 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many very fine tubular and interstitial pores; 15 percent angular cobbles and 40 percent angular pebbles; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—10 to 16 inches; light gray (10YR 7/2) extremely cobbly loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores; 20 percent angular cobbles and 40 percent angular pebbles; common fine soft masses of lime; common distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—16 inches; hard limestone with few vertical cracks.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to bedrock: 10 to 20 inches

A horizon
Hue: 2.5Y or 10YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 10 to 25 percent
Content of rock fragments: 15 to 60 percent—0 to 10 percent flagstones or cobbles; 15 to 50 percent pebbles or channers
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 2.5Y or 10YR
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 10 to 25 percent
Content of rock fragments: 35 to 70 percent—0 to 20 percent stones and cobbles; 35 to 50 percent pebbles
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.9 to 8.4

277F—Warneke-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform: Mountains
Position on landform:
- Warneke—Backslopes
- Rock outcrop—Backslopes and shoulders

Slope: 15 to 60 percent
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Warneke and similar soils: 70 percent
Rock outcrop: 20 percent

Minor Components
Whitecow and similar soils: 0 to 5 percent
Moderately deep soils: 0 to 5 percent

Major Component Description

Warneke
Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.0 inches

Rock outcrop
Definition: Hard limestone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

W—Water

Composition

Major Components
Water: 100 percent

Major Component Description

Definition: Areas of open water

Wayden Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills
Parent material: Material derived from shale and mudstone
Slope range: 8 to 60 percent
Elevation range: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Clayey, smectitic, calcareous, frigid, shallow Typic Ustorthents

Typical Pedon

Wayden clay, in an area of Regent-Wayden-Cabba complex, 15 to 45 percent slopes, in an area of rangeland, 1,600 feet north and 2,400 feet west of the southeast corner of sec. 34, T. 21 N., R. 8 W.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; hard, friable, moderately sticky, moderately plastic; many very fine roots; slightly alkaline; clear smooth boundary.

C1—4 to 10 inches; gray (5Y 6/1) silty clay, olive gray (5Y 4/2) moist; moderate fine and medium granular structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; 5 percent angular shale chips, strongly effervescent; slightly alkaline; clear smooth boundary.

C2—10 to 15 inches; gray (5Y 6/1) clay, greenish gray (5GY 5/1) moist; moderate fine and medium granular structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; 60 percent soft shale chips, strongly effervescent; slightly alkaline; gradual smooth boundary.

Cr—15 to 60 inches; light greenish gray (5GY 7/1) semiconsolidated shale, greenish gray (5GY 5/1) moist; few very fine roots following vertical cracks in upper part, strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 2.5Y or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 1 to 3
Clay content: 40 to 50 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

C horizons
Hue: 2.5Y or 5Y
Value: 5 to 8 dry; 3 to 6 moist
Chroma: 1 to 4
Texture: Silty clay, silty clay loam, or clay
Clay content: 35 to 50 percent
Electrical conductivity: 0 to 8 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

579E—Wayden-Cabba-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform:
- Wayden—Hills
- Cabba—Hills

Slope:
- Wayden—15 to 60 percent
- Cabba—15 to 60 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Wayden and similar soils: 45 percent
Cabba and similar soils: 40 percent
Rock outcrop: 10 percent

Minor Components
Very shallow soils: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Soils with gravelly loam surface layers: 0 to 1 percent

Major Component Description

Wayden
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

Rock outcrop
Definition: Sandstone and shale bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

679E—Wayden-Cabba-Regent complex, 15 to 45 percent slopes

Setting

Landform:
- Wayden—Hills
- Cabba—Hills
- Regent—Hills

Position on landform:
- Wayden—Backslopes and shoulders
- Cabba—Backslopes and shoulders
- Regent—Backslopes and footslopes

Slope:
- Wayden—15 to 45 percent
- Cabba—15 to 45 percent
- Regent—15 to 35 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Wayden and similar soils: 55 percent
Cabba and similar soils: 25 percent
Regent and similar soils: 15 percent

Minor Components
Farnuf and similar soils: 0 to 1 percent
Work and similar soils: 0 to 1 percent
Areas of rock outcrop: 0 to 1 percent
Very shallow soils: 0 to 1 percent
Soils with gravelly loam surface layers: 0 to 1 percent

Major Component Description

Wayden
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

Regent
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded sandstone and shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Weingart Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Hills and sedimentary plains
Parent material: Material derived from shale and semiconsolidated sedimentary beds
Slope range: 2 to 15 percent
Elevation range: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, smectitic, frigid Torrertic Natrustalfs

Typical Pedon

Weingart clay loam, 2 to 8 percent slopes, in an area of rangeland, 2,500 feet north and 2,300 feet west of the southeast corner of sec. 12, T. 11 N., R. 5 W.

E—0 to 4 inches; light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; moderate very thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine vesicular pores; neutral; abrupt smooth boundary.

Btn—4 to 10 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong medium columnar structure; very hard, firm, moderately sticky, and very plastic; common very fine roots; many very fine tubular pores; continuous prominent clay films on faces of peds; silt and sand skeletans on tops of columns; moderately alkaline; clear smooth boundary.

Btnk—10 to 17 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate medium prismatic structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct dark brown clay films on faces of peds; common faint very pale brown (10YR 7/3) coats on faces of peds with common fine irregularly shaped soft masses of lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

Bknyz—17 to 30 inches; pale yellow (5Y 7/3) silty clay loam, pale olive (5Y 6/3) moist; weak coarse prismatic structure; hard, friable, moderately sticky, moderately plastic; common very fine roots; common very fine tubular and interstitial pores; common fine seams of gypsum and other salts; common faint lime coats on faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

Cr—30 to 60 inches; reddish yellow (7.5YR 6/6) semiconsolidated sedimentary beds, strong brown (7.5YR 5/6) moist; few very fine roots in the upper part; common seams of gypsum; mildly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 7 to 16 inches
Depth to gypsum and other salts: 10 to 24 inches
Depth to bedrock: 20 to 40 inches

E horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 3 to 6 moist
Chroma: 2 or 3
Texture: Loam (clay loam when mixed to 7 inches)
Clay content: 27 to 40 percent
Content of rock fragments: 0 to 10 percent—0 to 10 percent stones and cobbles; 0 to 5 percent hard shale; 0 to 5 percent soft shale
Reaction: pH 5.6 to 7.8

Btn horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay, silty clay, or sandy clay
Clay content: 40 to 60 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent hard shale; 0 to 5 percent soft shale
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 10 to 25
Reaction: pH 6.6 to 9.6

Btnk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay, clay, sandy clay, or silty clay loam
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent hard shale; 0 to 5 percent soft shale
Electrical conductivity: 4 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 25
Gypsum content: None to common seams, 0 to 2 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

Bknyz horizon
Hue: 2.5Y or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Clay, silty clay, clay loam, or silty clay loam
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent hard shale; 0 to 5 percent soft shale
Electrical conductivity: 4 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Gypsum content: 1 to 5 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.8 to 9.6

Cr horizon
Material: Semiconsolidated shale or interbedded shale and sandstone
Reaction: Greater than 7.8

514B—Weingart-Assinniboine complex, 2 to 8 percent slopes

Setting

Landform:
• Weingart—Sedimentary plains
• Assinniboine—Alluvial fans
Slope:
• Weingart—2 to 8 percent
• Assinniboine—2 to 8 percent
Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Weingart and similar soils: 50 percent
Assinniboine and similar soils: 45 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 2 percent
Very deep loam soils: 0 to 2 percent
Moderately deep clayey soils: 0 to 1 percent

Major Component Description

Weingart
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, clayey sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 3.7 inches

Assinniboine
Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

614B—Weingart clay loam, 2 to 8 percent slopes

Setting

Landform: Sedimentary plains
Slope: 2 to 8 percent
Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Weingart and similar soils: 95 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 3 percent
Deep clayey soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, clayey sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

714B—Weingart-Musselshell complex, 2 to 8 percent slopes

Setting

Landform:
• Weingart—Sedimentary plains
• Musselshell—Alluvial fans
Slope:
• Weingart—2 to 8 percent
• Musselshell—2 to 8 percent
Elevation: 3,800 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Weingart and similar soils: 45 percent
Musselshell and similar soils: 40 percent

Minor Components
Very deep clay loam soils: 0 to 5 percent
Soils with gravelly loam surface layers: 0 to 5 percent
Soils with more rock fragments: 0 to 5 percent

Major Component Description

Weingart
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, clayey sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 3.7 inches

Musselshell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Whitecow Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium derived from limestone
Slope range: 8 to 60 percent
Elevation range: 4,000 to 6,000 feet
Mean annual precipitation: 12 to 25 inches
Frost-free period: 80 to 115 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Typic Calciustepts

Typical Pedon

Whitecow channery loam, 8 to 35 percent slopes, in an area of forestland, 1,500 feet south and 10 feet west of the northeast corner of sec. 15, T. 11 N., R. 5 W.

Oi—1 inch to 0; forest litter of needles and twigs; clear smooth boundary.
A—0 to 2 inches; light brownish gray (2.5Y 6/2) channery loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy parting to weak very fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common fine, medium, and coarse roots; 20 percent channers; strongly effervescent; moderately alkaline; abrupt smooth boundary.
Bk1—2 to 14 inches; light gray (10YR 7/2) channery loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common fine, medium, and coarse roots; 20 percent channers; disseminated lime; common distinct lime coats on undersides of rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.
Bk2—14 to 24 inches; very pale brown (10YR 7/3) extremely channery loam, yellowish brown (10YR 5/4) moist; common medium faint olive yellow (2.5Y 6/6) mottles; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and medium roots; 65 percent channers; disseminated lime; many prominent lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.
Bk3—24 to 40 inches; pale yellow (2.5Y 7/4) extremely channery loam, olive yellow (2.5Y 6/6) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine and medium roots; 65 percent channers; disseminated lime; many faint lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.
Bk4—40 to 60 inches; pale yellow (2.5Y 7/4) extremely channery loam, olive yellow (2.5Y 6/6) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; 80 percent channers; disseminated lime; many faint lime casts on undersides of rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 38 to 42 degrees F

A horizon
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 35 percent—0 to 10 percent stones and cobbles; 15 to 25 percent pebbles or channers
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

Bk1 and Bk2 horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 70 percent—0 to 30 percent stones and cobbles; 5 to 60 percent pebbles or channers
Calcium carbonate equivalent: 35 to 50 percent
Reaction: pH 7.4 to 9.0

Bk3 and Bk4 horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4 or 6
Texture: Loam, sandy loam, or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 60 to 90 percent—5 to 30 percent stones and cobbles; 55 to 70 percent pebbles or channers
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.4 to 9.0

85E—Whitecow channery loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 115 days

Composition

Major Components
Whitecow and similar soils: 90 percent

Minor Components
Warneke and similar soils: 0 to 4 percent
Soils that have slopes more than 35 percent: 0 to 3 percent
Moderately deep soils: 0 to 3 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

85F—Whitecow channery loam, 35 to 60 percent slopes

Setting

Landform: Mountains
Slope: 35 to 60 percent
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 105 days

Composition

Major Components
Whitecow and similar soils: 95 percent

Minor Components
Warneke and similar soils: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Soils that have slopes more than 60 percent: 0 to 1 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 2.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

285F—Whitecow, cool-Trapps, dry channery loams, 25 to 60 percent slopes

Setting

Landform:
- Whitecow—Mountains
- Trapps—Mountains

Slope:
- Whitecow—25 to 60 percent
- Trapps—25 to 60 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Whitecow and similar soils: 55 percent
Trapps and similar soils: 40 percent

Minor Components
Warneke and similar soils: 0 to 2 percent
Areas of rock outcrop: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Whitecow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Trapps
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

385E—Whitecow-Tolex channery loams, 8 to 35 percent slopes

Setting

Landform:
- Whitecow—Mountains
- Tolex—Mountains

Position on landform:
- Whitecow—Backslopes and footslopes
- Tolex—Backslopes and shoulders

Slope:
- Whitecow—8 to 35 percent
- Tolex—8 to 35 percent

Elevation: 4,000 to 4,500 feet
Mean annual precipitation: 12 to 15 inches
Frost-free period: 90 to 115 days

Composition

Major Components
Whitecow and similar soils: 50 percent
Tolex and similar soils: 45 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 1 percent
Deep loam textured soils: 0 to 1 percent
Soils with cobbly loam surface layers: 0 to 1 percent

Major Component Description

Whitecow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Tolex
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Argillite or igneous bedrock
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

441E—Whitecow-Crago-Pensore channery loams, 8 to 35 percent slopes

Setting

Landform:
- Whitecow—Mountains
- Crago—Alluvial fans
- Pensore—Mountains

Position on landform:
- Whitecow—Backslopes and footslopes
- Crago—Footslopes
- Pensore—Backslopes and shoulders

Slope:
- Whitecow—8 to 35 percent
- Crago—8 to 35 percent
- Pensore—8 to 35 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 15 inches
Frost-free period: 105 to 115 days

Composition

Major Components
Whitecow and similar soils: 40 percent
Crago and similar soils: 30 percent
Pensore and similar soils: 20 percent

Minor Components
Soils that have slopes more than 35 percent: 0 to 3 percent
Areas of rock outcrop: 0 to 3 percent
Soils with less rock fragments: 0 to 2 percent
Moderately deep soils: 0 to 2 percent

Major Component Description

Whitecow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Crago
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

Pensore
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

685F—Whitecow channery loam, cool, 25 to 60 percent slopes

Setting

Landform: Mountains
Slope: 25 to 60 percent
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 115 days

Composition

Major Components
Whitecow and similar soils: 95 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Soils that have slopes more than 60 percent: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

885F—Whitecow-Warneke channery loams, 15 to 45 percent slopes

Setting

Landform:
- Whitecow—Mountains
- Warneke—Mountains

Position on landform:
- Whitecow—Backslopes and footslopes
- Warneke—Backslopes and shoulders

Slope:
- Whitecow—15 to 45 percent
- Warneke—15 to 45 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Whitecow and similar soils: 70 percent
Warneke and similar soils: 20 percent

Minor Components
Soils that have slopes more than 45 percent: 0 to 3 percent
Moderately deep soils: 0 to 3 percent
Soils with darker colored surface layers: 0 to 3 percent
Soils with grass vegetation: 0 to 1 percent

Major Component Description

Whitecow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Warneke
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Whitore Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountains
Parent material: Colluvium derived from limestone
Slope range: 15 to 60 percent
Elevation range: 5,000 to 7,000 feet
Mean annual precipitation: 19 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, carbonatic Typic Eutrocryepts

Typical Pedon

Whitore channery loam, in an area of Whitore-Helmville channery loams, 15 to 35 percent slopes, in an area of forestland, 2,300 feet south and 1,200 feet east of the northwest corner of sec. 9, T. 11 N., R. 5 W.

Oi—2 inches to 0; forest litter of needles and twigs; clear smooth boundary.

A—0 to 4 inches; pale brown (10YR 6/3) channery loam, dark grayish brown (10YR 4/2) moist; weak thin platy parting to weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium and coarse roots; many very fine interstitial pores; common light brownish gray (10YR 6/2) silt and sand skeletans on faces of peds; 30 percent channers; slightly alkaline; clear smooth boundary.

Bw—4 to 16 inches; pale brown (10YR 6/3) channery loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine and fine and few medium and coarse roots; many very fine tubular and interstitial pores; 30 percent channers; thin white lime casts on undersides of coarse rock fragments in lower part; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bk1—16 to 45 inches; white (10YR 8/2) extremely channery loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine tubular and interstitial pores; 65 percent channers; thick white lime casts on undersides of coarse rock fragments; disseminated lime; common fine segregated soft masses and seams of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—45 to 60 inches; very pale brown (10YR 8/2) extremely channery loam, light yellowish brown (2.5Y 6/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; 80 percent channers; disseminated lime; continuous distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 38 to 42 degrees F

A horizon

Value: 4 to 6 dry; 3 or 4 moist
Chroma: 1 to 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 15 to 60 percent—0 to 25 percent stones and cobbles; 15 to 35 percent pebbles or channers
Reaction: pH 6.6 to 7.8

Bw horizon

Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam or loam
Clay content: 20 to 35 percent
Content of rock fragments: 15 to 60 percent—10 to 25 percent stones and cobbles; 5 to 35 percent pebbles or channers
Reaction: pH 6.6 to 7.8

Bk horizons

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Clay loam or loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 85 percent—0 to 40 percent stones and cobbles; 25 to 45 percent pebbles or channers
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.4 to 9.0

77F—Whitore-Tropal very channery loams, 25 to 60 percent slopes

Setting

Landform:
- Whitore—Mountains
- Tropal—Mountains

Position on landform:
- Whitore—Backslopes and footslopes
- Tropal—Backslopes and shoulders

Slope:
- Whitore—25 to 60 percent
- Tropal—26 to 60 percent

Elevation: 5,000 to 7,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Whitore and similar soils: 75 percent
Tropal and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Very shallow soils: 0 to 1 percent
Moderately deep soils: 0 to 1 percent
Soils that are noncalcareous to 15 inches: 0 to 1 percent

Major Component Description

Whitore
Surface layer texture: Very channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.1 inches

Tropal
Surface layer texture: Very channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

185E—Whitore-Helmville channery loams, 15 to 35 percent slopes

Setting

Landform:
- Whitore—Mountains
- Helmville—Mountains

Slope:
- Whitore—15 to 35 percent
- Helmville—15 to 35 percent

Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 19 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Whitore and similar soils: 60 percent
Helmville and similar soils: 35 percent

Minor Components
Soils that have slopes more than 35 percent: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Soils that are deep to bedrock: 0 to 1 percent

Major Component Description

Whitore
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.3 inches

Helmville
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

185F—Whitore-Helmville channery loams, 35 to 60 percent slopes

Setting

Landform:
- Whitore—Mountains
- Helmville—Mountains

Slope:
- Whitore—35 to 60 percent
- Helmville—35 to 60 percent

Elevation: 5,000 to 6,500 feet
Mean annual precipitation: 19 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Whitore and similar soils: 70 percent
Helmville and similar soils: 25 percent

Minor Components
Soils that have slopes more than 60 percent: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Soils that are deep to bedrock: 0 to 1 percent

Major Component Description

Whitore
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.3 inches

Helmville
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

785F—Whitore, dry-Tropal complex, 25 to 45 percent slopes

Setting

Landform:
- Whitore—Mountains
- Tropal—Mountains

Position on landform:
- Whitore—Backslopes and footslopes
- Tropal—Backslopes and shoulders

Slope:
- Whitore—25 to 45 percent
- Tropal—25 to 45 percent

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 19 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Whitore and similar soils: 70 percent
Tropal and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Very shallow soils: 0 to 2 percent
Very deep loam textured soils: 0 to 2 percent
Moderately deep soils: 0 to 2 percent
Soils with cobbly loam surface layers: 0 to 2 percent

Major Component Description

Whitore
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.2 inches

Tropal
Surface layer texture: Very gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 1.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Windham Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountains
Parent material: Alluvium and colluvium derived from limestone
Slope range: 4 to 45 percent
Elevation range: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Typic Calciustolls

Typical Pedon

Windham channery loam, 4 to 15 percent slopes, in an area of rangeland, 1,900 feet south and 1,600 feet east of the northwest corner of sec. 19, T. 12 N., R. 5 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky parting to moderate very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; 20 percent channers; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—7 to 30 inches; light gray (2.5Y 7/2) very channery loam, light yellowish brown (2.5Y 6/4) moist; weak fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 50 percent channers; disseminated lime; many prominent lime crusts on undersides of rock fragments; violently effervescent; strongly alkaline; gradual smooth boundary.

Bk2—30 to 60 inches; light brownish gray (2.5Y 6/2) extremely channery loam, light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; hard, friable, moderately sticky, slightly plastic; few very fine roots in upper part; common very

fine interstitial pores; 10 percent flagstones and 55 percent channers; disseminated lime; many prominent lime crusts on undersides of rock fragments; violently effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 41 to 46 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the calcic horizon: 5 to 10 inches

A horizon
Hue: 7.5YR or 10YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 35 percent—5 to 15 percent flagstones; 10 to 20 percent pebbles or channers
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 to 7 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 10 to 75 percent—0 to 20 percent cobbles; 10 to 55 percent pebbles
Calcium carbonate equivalent: 35 to 60 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 75 percent—0 to 20 percent cobbles; 35 to 55 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

64D—Windham channery loam, 4 to 15 percent slopes

Setting

Landform: Hills
Slope: 4 to 15 percent
Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Windham and similar soils: 95 percent

Minor Components
Very deep loam soils: 0 to 3 percent
Soils with cobbly loam surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

164E—Windham-Lap channery loams, 8 to 45 percent slopes

Setting

Landform:
- Windham—Hills
- Lap—Hills

Position on landform:
- Windham—Backslopes and footslopes
- Lap—Backslopes and shoulders

Slope:
- Windham—8 to 45 percent
- Lap—8 to 45 percent

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Windham and similar soils: 75 percent
Lap and similar soils: 20 percent

Minor Components
Whitecow and similar soils: 0 to 1 percent
Areas of rock outcrop: 0 to 1 percent
Very shallow soils: 0 to 1 percent
Moderately deep soils: 0 to 1 percent
Deep loamy soils: 0 to 1 percent

Major Component Description

Windham
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Lap
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

664E—Windham-Whitecow-Lap channery loams, 15 to 45 percent slopes

Setting

Landform:
- Windham—Mountains
- Whitecow—Mountains
- Lap—Mountains

Position on landform:
- Windham—Footslopes
- Whitecow—Backslopes and footslopes
- Lap—Shoulders

Slope:
- Windham—15 to 45 percent, south aspect
- Whitecow—15 to 45 percent, north aspect
- Lap—15 to 45 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Windham and similar soils: 45 percent
Whitecow and similar soils: 35 percent
Lap and similar soils: 15 percent

Minor Components
Soils that have slopes more than 45 percent: 0 to 2 percent
Very shallow soils: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Windham
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Whitecow
Surface layer texture: Channery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Limestone colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Lap
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Winspect Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Moraines and dissected stream terraces
Parent material: Alpine till
Slope range: 2 to 45 percent
Elevation range: 3,800 to 5,500 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Calciustolls

Typical Pedon

Winspect stony loam, in an area of Beanlake-Winspect stony loams, 4 to 25 percent slopes, in an area of rangeland, 20 feet south and 300 feet east of the northwest corner of sec. 6, T. 20 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; 5 percent stones and 15 percent pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—5 to 11 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 5 percent cobbles and 20 percent pebbles; disseminated lime; many prominent lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—11 to 42 inches; very pale brown (10YR 7/3) very cobbly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; 25 percent cobbles and 30 percent pebbles; many prominent lime casts on undersides of rock fragments; disseminated lime; many fine and medium seams and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bky—42 to 60 inches; very pale brown (10YR 7/3) very cobbly loam, brown (10YR 5/3) moist; moderate thin platy structure; slightly hard, friable, moderately sticky, slightly plastic; few very fine roots; common very fine tubular and interstitial pores; 25 percent cobbles and 35 percent pebbles; many fine seams and soft masses of lime; common fine seams and soft masses of gypsum; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F

A horizon
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 20 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent stones; 5 to 15 percent cobbles; 10 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 25 to 60 percent—0 to 5 percent stones; 5 to 25 percent cobbles; 20 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—10 to 25 percent cobbles; 25 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

Bky horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—10 to 25 percent cobbles; 25 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

443E—Winspect-Cabba-Wayden complex, 8 to 35 percent slopes

Setting

Landform:
- Winspect—Moraines
- Cabba—Hills
- Wayden—Hills

Slope:
- Winspect—8 to 35 percent
- Cabba—8 to 35 percent
- Wayden—8 to 35 percent

Elevation: 4,200 to 5,000 feet

Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Winspect and similar soils: 50 percent
Cabba and similar soils: 30 percent
Wayden and similar soils: 15 percent

Minor Components
Areas of rock outcrop: 0 to 2 percent
Moderately deep loamy soils: 0 to 2 percent
Soils shallow to hard bedrock: 0 to 1 percent

Major Component Description

Winspect
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

Wayden
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

833E—Winspect, dry-Cabbart complex, 15 to 45 percent slopes

Setting

Landform:
- Winspect—Moraines
- Cabbart—Hills

Slope:
- Winspect—15 to 45 percent
- Cabbart—15 to 45 percent

Elevation: 3,800 to 4,300 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Winspect and similar soils: 65 percent
Cabbart and similar soils: 20 percent

Minor Components
Delpoint and similar soils: 0 to 5 percent
Beanlake, dry soils: 0 to 5 percent
Soils that are clayey: 0 to 5 percent

Major Component Description

Winspect
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Woodgulch Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Permeability: Rapid
Landform: Mountains
Parent material: Material derived from coarse-grained granitic rock
Slope range: 8 to 35 percent
Elevation range: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Mixed, frigid Lamellic Ustipsamments

Typical Pedon

Woodgulch stony loamy sand, in an area of Woodgulch-Elbeth-Rock outcrop complex, 8 to 35 percent slopes, in an area of forestland, 1,200 feet north and 1,700 feet east of the southwest corner of sec. 12, T. 9 N., R. 5 W.

Oi—1 inch to 0; forest litter of needles and twigs; abrupt smooth boundary.

A—0 to 4 inches; grayish brown (10YR 5/2) stony loamy sand, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine and few medium and coarse roots; many clear sand grains; 5 percent stones, 5 percent cobbles; and 5 percent pebbles; moderately acid; clear smooth boundary.

E—4 to 13 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium prismatic parting to weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine and few medium and coarse roots; many very fine tubular and interstitial pores; many clear sand grains coats on faces of peds; slightly acid; gradual smooth boundary.

E/Bt—13 to 30 inches; 85 percent pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist (E part); 15 percent) pale brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) moist (B part); weak fine and medium subangular blocky structure; hard, friable, slightly sticky, nonplastic; common very fine and fine and few medium and coarse roots; many very fine tubular and interstitial pores; few faint clay films on faces of peds and bridging sand grains; many bleached sand grains on faces of peds; slightly acid; gradual smooth boundary.

E and Bt—30 to 50 inches; 95 percent pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist (E part); 5 percent brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist (B part); weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; few very fine and fine roots; many very fine tubular and interstitial pores; many clear sand grains; lamellae are 1/8- to 1/4-inch thick and total 1-inch thickness and texture to a sandy clay loam; 5 percent pebbles; slightly acid; gradual smooth boundary.

C—50 to 60 inches; light brownish gray (2.5Y 6/2) coarse sand, grayish brown (2.5Y 5/2) moist; single grain; loose; 10 percent pebbles; slightly acid.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A horizon
Value: 4 or 5 dry; 3 moist
Chroma: 1 or 2
Clay content: 5 to 10 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent stones; 0 to 10 cobbles; 5 to 15 percent pebbles
Reaction: pH 5.6 to 6.5

E horizon
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 5 to 10 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.1 to 7.3

E/Bt horizon
Value: E part—6 or 7 dry; 2 to 4 moist; B part—5 or 6 dry; 3 or 4 moist
Chroma: 3 or 4
Clay content: 5 to 10 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.1 to 7.3

E and Bt horizon
Value: E part—6 or 7 dry; 2 to 4 moist; B part—5 or 6 dry; 3 or 4 moist
Chroma: 3 or 4
Lamellae: Combined thickness of 1/4 to 3 inches
Clay content: 5 to 10 percent
Content of rock fragments: 0 to 5 percent
Reaction: pH 6.1 to 7.3

C horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 1 or 2
Texture: Coarse sand or loamy sand
Clay content: 0 to 5 percent
Content of rock fragments: 5 to 30 percent pebbles
Reaction: pH 6.1 to 7.3

286E—Woodgulch-Elbeth-Rock outcrop complex, 8 to 35 percent slopes

Setting

Landform:
- Woodgulch—Mountains
- Elbeth—Mountains

Position on landform:
- Woodgulch—Backslopes
- Elbeth—Footslopes
- Rock outcrop—Shoulders

Slope:
- Woodgulch—8 to 35 percent
- Elbeth—8 to 35 percent

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Woodgulch and similar soils: 45 percent
Elbeth and similar soils: 30 percent
Rock outcrop: 15 percent

Minor Components
Soils shallow to bedrock: 0 to 4 percent
Soils that have slopes more than 35 percent: 0 to 3 percent
Very deep sandy loam soils: 0 to 3 percent

Major Component Description

Woodgulch
Surface layer texture: Stony loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Granitic colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Elbeth
Surface layer texture: Very stony sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Granitic colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 6.2 inches

Rock outcrop
Definition: Coarse-grained granite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Work Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Alluvial fans, stream terraces, and hills
Parent material: Alluvium
Slope range: 0 to 30 percent
Elevation range: 3,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, smectitic, frigid Typic Argiustolls

Typical Pedon

Work clay loam, in an area of Work-Farnuf complex, 2 to 10 percent slopes, in an area of rangeland, 1,700 feet north and 1,300 feet west of the southeast corner of sec. 7, T. 19 N., R. 6 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; slightly alkaline; clear smooth boundary.

Bt1—4 to 8 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine prismatic parting to strong fine subangular blocky structure; hard, firm, moderately sticky, moderately plastic; many very fine roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; slightly alkaline; gradual smooth boundary.

Bt2—8 to 14 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong fine and medium

prismatic parting to strong fine subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; continuous prominent very dark grayish brown (10YR 3/2) moist clay films on faces of peds; slightly alkaline; gradual smooth boundary.

Btk—14 to 25 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—25 to 60 inches; light gray (2.5Y 7/2) clay loam, olive gray (5Y 5/2) moist; weak medium prismatic parting to weak medium and coarse angular blocky structure; hard, friable, moderately sticky, moderately plastic; few very fine roots; many very fine tubular and interstitial pores; common fine and medium seams and soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Bk horizon: 14 to 30 inches
Soil phases: Stony

A horizon
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam (clay loam when mixed to 7 inches)
Clay content: 20 to 40 percent
Content of rock fragments: 0 to 35 percent—0 to 15 percent stones and cobbles; 0 to 20 percent pebbles
Reaction: pH 6.1 to 7.8

Bt horizons
Value: 4 or 5 dry; 2 to 4 moist
Chroma: 2 or 3
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 50 percent with more than 15 percent fine sand and coarser
Content of rock fragments: 0 to 15 percent—0 to 5 percent stones and cobbles; 0 to 10 percent pebbles
Reaction: pH 6.6 to 7.8

Btk horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay or clay loam
Clay content: 20 to 40 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent stones and cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 15 to 40 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

544A—Work-Farnuf complex, 0 to 2 percent slopes

Setting

Landform:
- Work—Stream terraces
- Farnuf—Stream terraces

Slope:
- Work—0 to 2 percent
- Farnuf—0 to 2 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Work and similar soils: 60 percent
Farnuf and similar soils: 35 percent

Minor Components
Soils that have slopes more than 2 percent: 0 to 2 percent
Moderately sodic soils: 0 to 2 percent
Soils with very gravelly substratums: 0 to 1 percent

Major Component Description

Work
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.1 inches

Farnuf
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

544C—Work-Farnuf complex, 2 to 10 percent slopes

Setting

Landform:
- Work—Alluvial fans
- Farnuf—Alluvial fans

Slope:
- Work—2 to 10 percent
- Farnuf—2 to 10 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Work and similar soils: 50 percent
Farnuf and similar soils: 40 percent

Minor Components
Hilger and similar soils: 0 to 5 percent
Regent and similar soils: 0 to 5 percent

Major Component Description

Work
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.2 inches

Farnuf
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

644C—Work stony loam, 2 to 15 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 15 percent
Elevation: 3,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Work and similar soils: 95 percent

Minor Components
Regent and similar soils: 0 to 2 percent
Hilger and similar soils: 0 to 1 percent
Farnuf and similar soils: 0 to 1 percent
Soils with silty clay subsoil: 0 to 1 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

744C—Work cobbly clay loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Work and similar soils: 95 percent

Minor Components
Farnuf and similar soils: 0 to 2 percent
Soils with stony clay loam surface layers: 0 to 1 percent
Soils with clay loam surface layers: 0 to 1 percent
Soils with very gravelly substratums: 0 to 1 percent

Major Component Description

Surface layer texture: Cobbly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

844C—Work clay loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Work and similar soils: 90 percent

Minor Components
Farnuf and similar soils: 0 to 3 percent
Soils with very gravelly substratums: 0 to 3 percent
Slightly sodic soils: 0 to 2 percent
Soils with lighter colored surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Worock Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Mountains
Parent material: Alpine till
Slope range: 8 to 60 percent
Elevation range: 4,600 to 6,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Eutric Haplocryalfs

Typical Pedon

Worock stony loam, 8 to 35 percent slopes, in an area of forestland, 2,400 feet north and 2,100 feet east of the southwest corner, of sec. 9, T. 14 N., R. 9 W.

Oi—3 inches to 0; forest litter of slightly decomposed needles, twigs, and roots.
E1—0 to 5 inches; light gray (10YR 7/2) stony loam, grayish brown (10YR 5/2) moist; moderate thin platy structure; soft, very friable, slightly sticky,

slightly plastic; many very fine and fine and common medium roots; many very fine tubular and interstitial pores; 5 percent stones, 5 percent cobbles, and 20 percent pebbles; neutral; gradual smooth boundary.

E2—5 to 9 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; many very fine tubular and interstitial pores; 5 percent cobbles and 20 percent pebbles; neutral; clear smooth boundary.

Bt1—9 to 18 inches; light yellowish brown (10YR 6/4) very cobbly clay loam, dark yellowish brown (10YR 4/4) moist; strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct dark brown (10YR 4/3) moist clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; neutral; gradual smooth boundary.

Bt2—18 to 30 inches; brownish yellow (10YR 6/6) very cobbly clay loam, yellowish brown (10YR 5/6) moist; moderate medium and coarse subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; many distinct yellowish brown (10YR 5/4) moist clay films on faces of peds; common very dark grayish brown (10YR 3/2) moist organic stains in root channels; 20 percent cobbles and 20 percent pebbles; neutral; gradual smooth boundary.

Bt3—30 to 60 inches; brownish yellow (10YR 6/6) very cobbly clay loam, dark yellowish brown (10YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine, fine, and medium roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 30 percent cobbles and 20 percent pebbles; neutral.

Range in Characteristics

Soil temperature: 37 to 45 degrees F
Depth to the argillic horizon: 6 to 20 inches

E horizons
Value: 6 or 7 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 35 percent—5 to 15 percent stones and cobbles; 10 to 20 percent pebbles
Reaction: pH 5.1 to 6.5

Bt horizons
Hue: 10YR or 7.5YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 4 or 6
Texture: Loam, clay loam, or sandy clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 35 to 65 percent—0 to 10 percent stones; 5 to 15 percent cobbles; 25 to 45 percent pebbles
Reaction: pH 5.6 to 6.5

15E—Worock-Mikesell stony loams, 8 to 35 percent slopes

Setting

Landform:
- Worock—Mountains
- Mikesell—Mountains

Slope:
- Worock—8 to 35 percent
- Mikesell—8 to 35 percent

Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Worock and similar soils: 55 percent
Mikesell and similar soils: 40 percent

Minor Components
Very deep loam soils: 0 to 1 percent
Soils that have slopes more than 35 percent: 0 to 1 percent
Soils with cobbly loam surface layers: 0 to 1 percent
Soils that are poorly drained and ponded: 0 to 1 percent
Soils with gravelly loam surface layers: 0 to 1 percent

Major Component Description

Worock
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

Mikesell
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 8.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

19E—Worock stony loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Worock and similar soils: 95 percent

Minor Components
Mikesell and similar soils: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 1 percent
Soils with less rock fragments: 0 to 1 percent
Soils that are poorly drained and ponded: 0 to 1 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

19F—Worock stony loam, 35 to 60 percent slopes

Setting

Landform: Mountains
Slope: 35 to 60 percent
Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 20 to 30 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Worock and similar soils: 95 percent

Minor Components
Mikesell and similar soils: 0 to 2 percent
Soils that have slopes more than 60 percent: 0 to 1 percent
Soils with less rock fragments: 0 to 1 percent
Soils that are poorly drained and ponded: 0 to 1 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

119E—Worock stony loam, warm, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 4,600 to 5,500 feet

Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Worock and similar soils: 90 percent

Minor Components
Libeg and similar soils: 0 to 4 percent
Soils that have slopes more than 35 percent: 0 to 3 percent
Soils with less rock fragments: 0 to 3 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

219E—Worock, warm-Libeg stony loams, 8 to 35 percent slopes

Setting

Landform:
- Worock—Mountains
- Libeg—Mountains

Position on landform:
- Worock—Backslopes
- Libeg—Backslopes and footslopes

Slope:
- Worock—8 to 35 percent
- Libeg—8 to 35 percent, south aspect

Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 20 to 25 inches
Frost-free period: 50 to 70 days

Composition

Major Components
Worock and similar soils: 60 percent
Libeg and similar soils: 35 percent

Minor Components
Leavitt and similar soils: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Moderately deep soils: 0 to 1 percent

Major Component Description

Worock
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.9 inches

Libeg
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Yamacall Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans, stream terraces, and uplands
Parent material: Alluvium
Slope range: 0 to 8 percent
Elevation range: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Haplustepts

Typical Pedon

Yamacall silt loam, 2 to 8 percent slopes, in an area of cropland, 600 feet north and 1,800 feet west of the southeast corner of sec. 9, T. 20 N., R. 5 W.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—5 to 12 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; moderate medium prismatic parting to moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; few fine irregular soft masses and seams; violently effervescent; moderately alkaline; clear smooth boundary.

Bk1—12 to 31 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak medium prismatic parting to weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; disseminated lime; common fine irregular soft masses and seams of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—31 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; disseminated lime; few fine soft masses; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 10 to 20 inches

Ap horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or silt loam
Clay content: 18 to 30 percent with 15 to 35 percent fine sand and coarser
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 6.6 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or silt loam
Clay content: 18 to 30 percent with 15 to 35 percent fine sand and coarser
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

24A—Yamacall silt loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Yamacall and similar soils: 90 percent

Minor Components
Soils that have slopes more than 2 percent: 0 to 3 percent
Attewan and similar soils: 0 to 3 percent
Soils with loam surface layers: 0 to 2 percent
Soils with darker colored surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

24C—Yamacall silt loam, 2 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 2 to 8 percent
Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Yamacall and similar soils: 90 percent

Minor Components
Soils that have slopes more than 8 percent: 0 to 3 percent
Attewan and similar soils: 0 to 3 percent
Soils with loam surface layers: 0 to 2 percent
Soils with darker colored surface layers: 0 to 2 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

116B—Yamacall-Gerdrum complex, 0 to 4 percent slopes

Setting

Landform:
- Yamacall—Alluvial fans
- Gerdrum—Alluvial fans

Position on landform:
- Yamacall—Microhighs
- Gerdrum—Microlows

Slope:
- Yamacall—0 to 4 percent
- Gerdrum—0 to 4 percent

Elevation: 3,500 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Yamacall and similar soils: 65 percent
Gerdrum and similar soils: 25 percent

Minor Components
Delpoint and similar soils: 0 to 3 percent
Soils that have slopes more than 4 percent: 0 to 2 percent
Soils with strongly saline surface layers: 0 to 2 percent
Soils with darker colored surface layers: 0 to 2 percent
Soils with loam surface layers: 0 to 1 percent

Major Component Description

Yamacall
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Gerdrum
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

569A—Yamacall-Attewan loams, 0 to 2 percent slopes

Setting

Landform:
• Yamacall—Stream terraces
• Attewan—Stream terraces
Slope:
• Yamacall—0 to 2 percent
• Attewan—0 to 2 percent
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 105 to 120 days

Composition

Major Components
Yamacall and similar soils: 50 percent
Attewan and similar soils: 45 percent

Minor Components
Soils that have slopes more than 2 percent: 0 to 2 percent
Soils with shallow to sand and gravel: 0 to 2 percent
Very deep silt loam soils: 0 to 1 percent

Major Component Description

Yamacall
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Attewan
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Yourame Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Mountains
Parent material: Alpine till
Slope range: 8 to 35 percent
Elevation range: 4,500 to 5,200 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Haplustalfs

Typical Pedon

Yourame stony loam, 8 to 35 percent slopes, in an area of forestland, 1,500 feet south and 1,500 feet west of the northeast corner of sec. 15, T. 14 N., R. 8 W.

Oi—2 inches to 0; forest litter of slightly decomposed needles and twigs.

E1—0 to 6 inches; light brownish gray (10YR 6/2) stony loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy parting to moderate very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 3 percent stones, 5 percent cobbles, and 15 percent pebbles; neutral; clear smooth boundary.

E2—6 to 15 inches; pinkish gray (7.5YR 6/2) gravelly sandy loam, brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; 5 percent cobbles and 10 percent pebbles; neutral; gradual smooth boundary.

Bt1—15 to 29 inches; light brown (7.5YR 6/4) very cobbly sandy clay loam, dark brown (7.5YR 4/4) moist; strong fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; continuous distinct clay films on faces of peds; 20 percent cobbles and 25 percent pebbles; slightly acid; gradual smooth boundary.

Bt2—29 to 60 inches; pinkish gray (7.5YR 7/2) very cobbly sandy clay loam, brown (7.5YR 5/4) moist;

moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; many very fine tubular and interstitial pores; common distinct clay films on faces of peds; 20 percent cobbles and 30 percent pebbles; slightly acid.

Range in Characteristics

Soil temperature: 42 to 46 degrees F

E1 horizon
Value: 6 or 7 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 7 to 20 percent
Content of rock fragments: 15 to 35 percent—5 to 15 percent stones and cobbles; 15 to 35 percent pebbles
Reaction: pH 5.6 to 7.3

E2 horizon
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 7 to 20 percent
Content of rock fragments: 15 to 35 percent—0 to 10 percent stones and cobbles; 15 to 25 percent pebbles
Reaction: pH 5.6 to 7.3

Bt horizons
Hue: 10YR or 7.5YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—5 to 20 percent stones and cobbles; 30 to 40 percent pebbles
Reaction: pH 5.6 to 7.3

784D—Yourame stony loam, 8 to 35 percent slopes

Setting

Landform: Mountains
Slope: 8 to 35 percent
Elevation: 4,500 to 5,200 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 70 to 90 days

Composition

Major Components
Yourame and similar soils: 90 percent

Minor Components
Soils with sand and gravel at 30 inches: 0 to 4 percent
Soils that are poorly drained and ponded: 0 to 2 percent
Soils with darker colored surface layers: 0 to 2 percent
Soils with less rock fragments: 0 to 2 percent

Major Component Description

Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

References

Alexander, R.R., 1966. Site indexes for lodgepole pine with corrections for stand density; instructions for field use. U.S. Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station Research Paper, RP-24.

Alexander, R.R., 1967. Site indexes for Engelmann spruce. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper, RP-32.

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1988. Standard test method for classification of soils for engineering purposes. ASTM Standard D 2487-00.

Baker, F.S. 1925. Aspen in the Central Rocky Mountain Region. United States Department of Agriculture Bulletin 1291.

Brickell, J.E. 1968. A method for constructing site index curves from measurements of tree age and height—Its application to inland Douglas-fir. U.S. Department of Agriculture, Forest Service, Intermountain Research Station Research Paper INT-RP-47.

Brown, P.L., and G.R. Carlson. 1990. Grain yields related to stored soil water and growing season rainfall. Montana Agricultural Experiment Station Special Report Number 35.

Dahms, W.G. 1964. Gross and net yield tables for lodgepole pine. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR, Research Paper PNW-8.

Meyer, W.H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Department of Agriculture, Technical Bulletin 630. Washington, DC.

Montana Agricultural Statistics Service. 1989. Montana Agricultural Statistics. County Statistics 1987-1988. Volume XXVI.

Montana Department of State Lands, Division of Forestry, and U.S. Department of Agriculture, Forest Survey, Intermountain Forest and Range Experiment Station. 1984. Timber resources of the Headwater Counties. Working Circle 3.

Myers, C.A. 1967. Yield tables for managed stands of lodgepole pine in Colorado and Wyoming. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper RM-RP-26.

O'Brien R.A., and D.C. Collins. 1991. Forest statistics for land outside national forests in West-Central Montana, 1989. U.S. Department of Agriculture, Intermountain Research Station Research Bulletin INT-RB-72.

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. U.S. Department of Agriculture, Forest Service, Intermountain Research Station General Technical Report INT-GTR-34.

Soil Survey Division Staff. 1962. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1998. Keys to soil taxonomy. 8th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

United States Department of Agriculture; Division of Soil Survey; Bureau of Plant Industry, Soils, and Agricultural Engineering. 1947. Soils of Lewis and Clark County: Soil Reconnaissance of Montana. In cooperation with the Montana State College, Agricultural Experiment Station, Department of Agronomy and Soils. Preliminary Report. Bulletin 445.

United States Department of Agriculture, Natural Resources Conservation Service. Montana Field Office Technical Guide, Section II. (http://www.nrcs.usda.gov/technical/efotg/)

United States Department of Agriculture, Natural Resources Conservation Service. National forestry handbook, title 190. (http://soils.usda.gov/technical/nfhandbook/)

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov/technical/handbook/)

United States Department of Agriculture, Soil Conservation Service. 1976. National range handbook. (http://www.glti.nrcs.usda.gov/technical/publications/nrph.html)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. (See Sodic (alkali) soil.)

Alluvial fan. A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hillslopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redox feature.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redox features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillite. Weakly metamorphosed mudstone or shale.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Avalanche chute. The track or path formed by an avalanche.

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular

to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding planes. Fine strata, less than 5-millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-floored plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of cobbles or gravel. In some blowouts, the water table is exposed.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Bouldery. Refers to a soil with .01 to 0.1 percent of the surface covered with boulders.

Bouldery soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments larger than 24 inches (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channeled. Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.

Channery soil material. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque. A semicircular, concave, bowl-like area that has steep faces primarily resulting from erosive activity of a mountain glacier.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey soil. Silty clay, sandy clay, or clay.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from the adjacent stands.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Closed depression. A low area completely surrounded by higher ground and having no natural outlet.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Codominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

COLE (coefficient of linear extensibility). (See Linear extensibility.)

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest. Forestland capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion. In areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to

compression. Terms describing consistence are defined in the "Soil Survey Manual" (Soil Survey Division Staff, 1962).

Consolidated sandstone. Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.

Consolidated shale. Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deep soil. A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Dominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well-drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet, at or near the surface, during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.

Even aged. Refers to a stand of trees in which only small differences in age occur between individual trees. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well-preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface profile is dominantly concave. In terms of gradational processes, a footslope is a transitional zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Giant ripple mark. The undulating surface sculpture produced in noncoherent granular materials by currents of water and by the agitation of water in

wave action during the draining of large glacial lakes, such as Glacial Lake Missoula.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciated uplands. Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Soil that is 15 to 35 percent, by volume, rounded or angular rock fragments up to 3 inches (7.6 centimeters) in diameter. Very gravelly soil is 35 to 60 percent gravel, and extremely gravelly soil is more than 60 percent gravel by volume.

Grazeable forestland. Land capable of sustaining livestock grazing by producing forage of sufficient quantity during one or more stages of secondary forest succession.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. A mineral consisting of hydrous calcium sulfate.

Habitat type. An aggregation of all land areas capable of producing similar climax plant communities.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual" (Soil Survey Division Staff, 1962). The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A or E horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame terrace. A terracelike ridge consisting of stratified sand and gravel that were deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

Krotovina. A filled faunal burrow—Irregular tubular streaks caused by the filling of tunnels made by burrowing animals in one layer with material from outside the layer. In a profile, they appear rounded or elliptical. Their textures and structures may be unlike those of the soil around them.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well-sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lateral moraine. A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking or by mass wasting.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting

of iron oxide or manganese oxide generally are considered a type of redox concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microhigh. An area that is 2 to 12 inches higher than the adjacent microlow.

Microlow. An area that is 2 to 12 inches lower than the adjacent microhigh.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Miscellaneous water. A sewage lagoon, an industrial waste pit, a fish hatchery, or a similar water area.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Areas of color that differ from the matrix color. These colors are commonly attributes retained from the geologic parent material. (See Redox features for indications of poor aeration and impeded drainage.)

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well-decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Naturalized pasture. Forestland that is used primarily for the production of forage for grazing by livestock rather than for the production of wood products. Overstory trees are removed or managed to promote the native and introduced understory vegetation occurring on the site. This vegetation is managed for its forage value through the use of grazing management principles.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Overstory. The trees in a forest that form the upper crown cover.

Oxbow. The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile.

Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit. The range of moisture content within which the soil remains plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential natural community (PNC). The biotic community that would become established on an ecological site if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in its development. The PNC may include acclimatized or naturalized nonnative species.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Quartzite, metamorphic. Rock consisting mainly of quartz that formed through recrystallization of quartz-rich sandstone or chert.

Quartzite, sedimentary. Very hard but unmetamorphosed sandstone consisting chiefly of quartz grains.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. (See Similarity index.)

Range site. (See Ecological site.)

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Recessional moraine. A moraine formed during a temporary but significant halt in the retreat of a glacier.

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redox concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redox depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redox features. Redox concentrations, redox depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redox feature.

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relict stream terrace. One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Riser. The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, boulders, stones, cobbles, and gravel.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Rubble land. Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of

cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salinity. The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline	0 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Sedimentary plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sedimentary uplands. Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

Seepage (in tables). The movement of water through soil. Seepage adversely affects the specified use.

Semiconsolidated sedimentary beds. Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shelterwood system. A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid regeneration of the more intolerant tree species in a stand.

Shoulder. The uppermost inclined surface at the top of a hillside. It is the transitional zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Similarity index. A similarity index is the percentage of a specific vegetation state plant community that is presently on the site.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is loamy or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The

degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with tillage, or stones cover .01 to 0.1 percent of the surface. Very stony means that 0.1 to 3.0 percent of the surface is covered with stones. Extremely stony means that 3 to 15 percent of the surface is covered with stones.

Stony soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Strath terrace. A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that is restrictive to roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tailwater. The water directly downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Terracette. Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may or may not be induced by trampling of livestock such as sheep or cattle.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive, nearly level to gently rolling or moderately sloping area that is underlain by or consists of till and that has a slope of 0 to 8 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Tread. The relatively flat terrace surface that was cut or built by stream or wave action.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded

glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water-spreading. Diverting runoff from natural channels by means of a system of dams, dikes, or ditches and spreading it over relatively flat surfaces.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

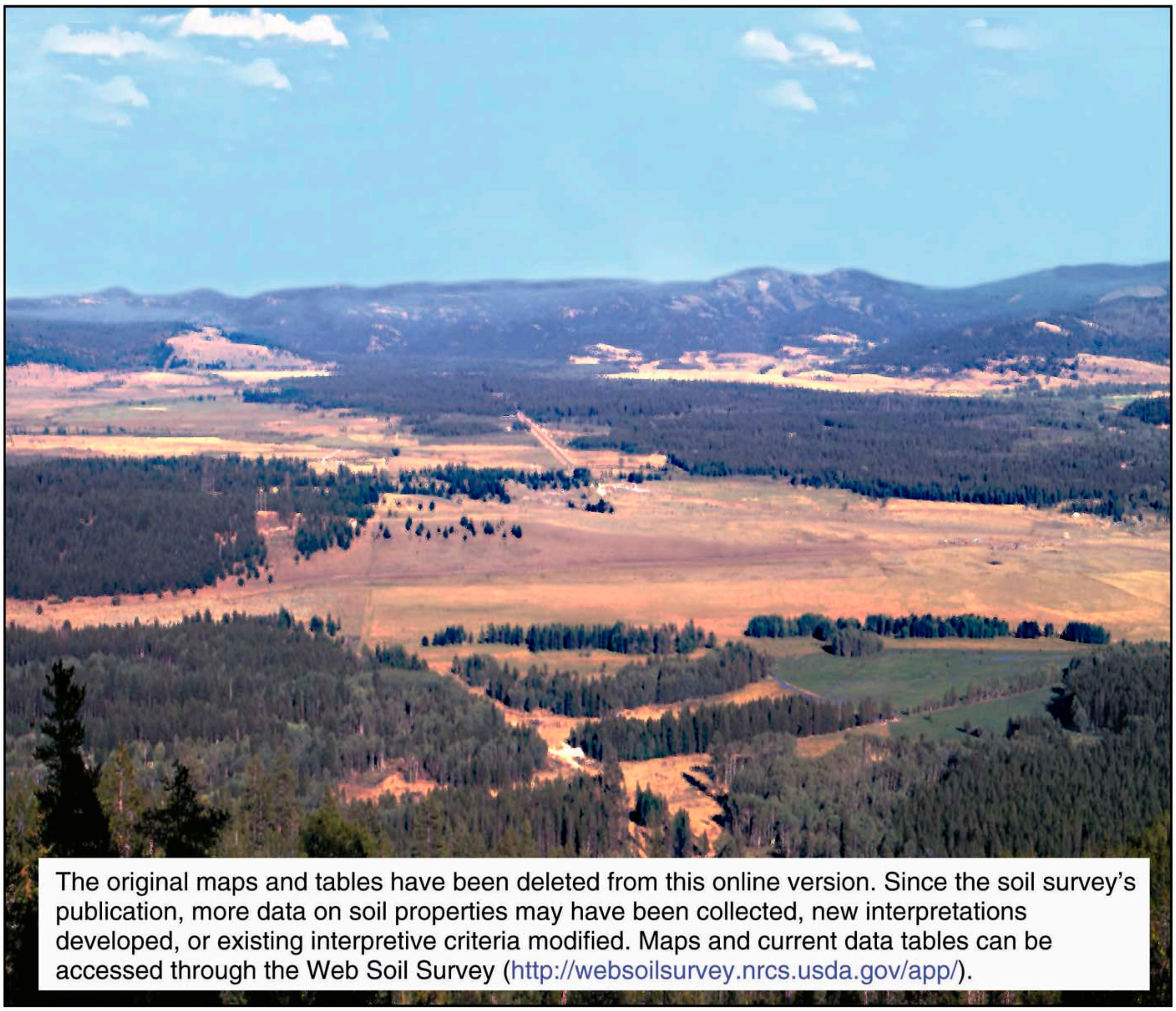
United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with the
Montana Agricultural
Experiment Station

MT630—Soil Survey of Lewis and Clark County Area, Montana

Part II



The original maps and tables have been deleted from this online version. Since the soil survey's publication, more data on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. Maps and current data tables can be accessed through the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/).

How to Use This Soil Survey

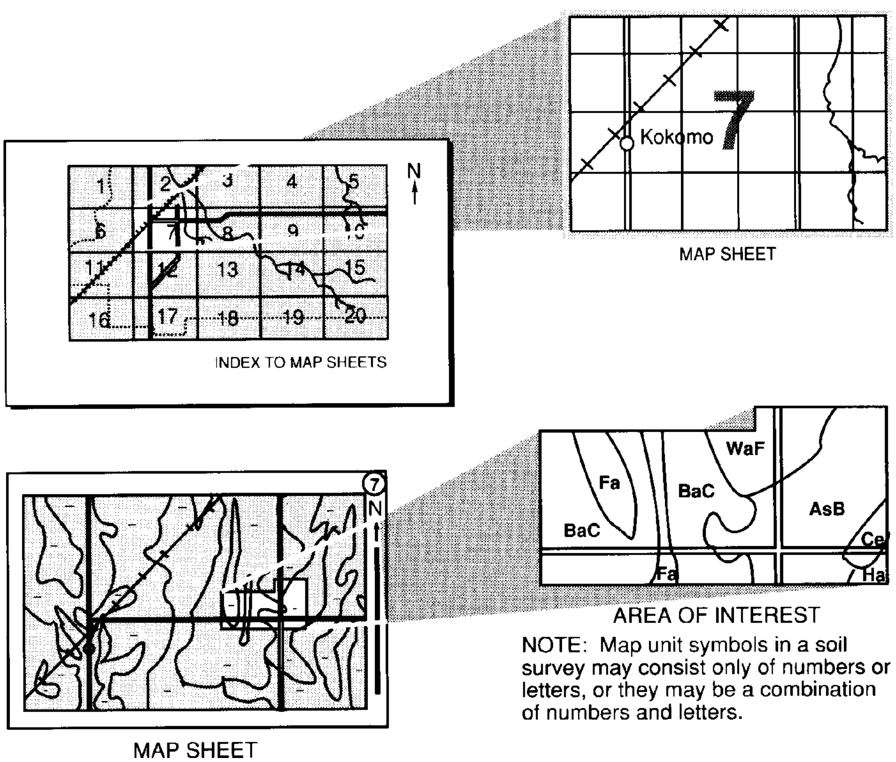
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, you can locate that area on the **Index to Map Sheets**. Go to the Web Soil Survey for more information (http://websoilsurvey.nrcs.usda.gov/app/)

Note the map unit symbols that are in that area. Go to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

See the Contents for sections of this publication that may address your specific needs.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Lewis and Clark Conservation District. Financial assistance was provided by the Old West Regional Commission through the Montana Department of State Lands and the Montana Association of Conservation Districts.

The most current official data are available through the NRCS Soil Data Mart website at http://soildatamart.nrcs.usda.gov. Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: View of the Lincoln Valley area in the western part of Lewis and Clark County. The soils in this area are used mainly for woodland, rangeland, and irrigated hayland.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

Contents

Issued 2003

Detailed Soil Map Unit Legend

1B—Aridic Ustifluvents, 0 to 4 percent slopes
2A—Larry silt loam, cool, 0 to 2 percent slopes
3A—Fairway silt loam, cool, 0 to 2 percent slopes
4B—Silvercity gravelly loam, 1 to 4 percent slopes
5B—Stady-Wabek complex, 1 to 4 percent slopes
6A—Totelake gravelly loam, 0 to 3 percent slopes
7A—Silverking silt loam, 0 to 3 percent slopes
8A—Stryker silt loam, cool, 0 to 2 percent slopes
9A—Scravo gravelly loam, 0 to 2 percent slopes
12A—Korell loam, 0 to 2 percent slopes, rarely flooded
13B—Stady silt loam, cool, 1 to 4 percent slopes
15E—Worock-Mikesell stony loams, 8 to 35 percent slopes
16B—Gerdrum-Nobe-Yamacall complex, 0 to 4 percent slopes
17A—Havre silt loam, 0 to 2 percent slopes
19E—Worock stony loam, 8 to 35 percent slopes
19F—Worock stony loam, 35 to 60 percent slopes
20A—Fairway silt loam, 0 to 2 percent slopes
23E—Hanson channery loam, 8 to 35 percent slopes
24A—Yamacall silt loam, 0 to 2 percent slopes
24C—Yamacall silt loam, 2 to 8 percent slopes
25F—Tolex-Mocmont-Rock outcrop complex, cool, 25 to 60 percent slopes
26C—Brocko silt loam, 2 to 8 percent slopes
26D—Brocko silt loam, 8 to 15 percent slopes
27F—Mocmont-Bignell-Tolex very stony loams, 25 to 60 percent slopes
33B—Sappington-Amesha loams, 1 to 4 percent slopes
33C—Sappington-Amesha loams, 4 to 8 percent slopes
34B—Sieben gravelly loam, 2 to 8 percent slopes
39B—Chinook sandy loam, 2 to 8 percent slopes
40D—Rock outcrop-Rubble land
41C—Rootel-Musselshell loams, 2 to 8 percent slopes
42B—Fairfield cobbly loam, 1 to 4 percent slopes
43A—Niart loam, 0 to 3 percent slopes
61E—Holter-Castner channery loams, 8 to 45 percent slopes
63D—Mocmont-Tolex complex, 8 to 25 percent slopes
63F—Mocmont-Tolex complex, 25 to 60 percent slopes
64D—Windham channery loam, 4 to 15 percent slopes
69A—Farnuf loam, 0 to 2 percent slopes
69B—Farnuf loam, 2 to 4 percent slopes
69C—Farnuf loam, 4 to 10 percent slopes
71E—Sawbuck loam, 15 to 45 percent slopes
73D—Bridger loam, 4 to 25 percent slopes
77F—Whitore-Tropal very channery loams, 25 to 60 percent slopes
80C—Regent clay loam, 2 to 10 percent slopes
84E—Mocmont-Tolex complex, cool, 8 to 25 percent slopes
84F—Mocmont-Tolex complex, cool, 25 to 60 percent slopes
85E—Whitecow channery loam, 8 to 35 percent slopes
85F—Whitecow channery loam, 35 to 60 percent slopes
86F—Comad extremely stony sandy loam, 25 to 45 percent slopes
88B—Shawa loam, 2 to 8 percent slopes
89D—Geohrock channery loam, cool, 4 to 25 percent slopes
90F—Elve extremely stony sandy loam, 25 to 60 percent slopes
91B—Cadotte gravelly loam, 0 to 4 percent slopes
93E—Libeg-Cheadle very channery loams, 15 to 45 percent slopes
95E—Rittel-Tolex complex, 15 to 35 percent slopes
96E—Swiftcurrent loam, 8 to 35 percent slopes
96F—Swiftcurrent loam, 35 to 65 percent slopes

Summary of Tables

For tables with the most current data, please visit the
Soil Data Mart at **http://soildatamart.nrcs.usda.gov/.**

Soil Survey of
Lewis and Clark County Area, Montana

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. In addition, this survey can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. To predict soil behavior, field experience and collected data on soil properties and performance are used.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. This information can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Although soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

“Classification of the Soils” and “Acreage and Proportionate Extent of the Soils” tables at the end of this section show the classification and extent of the soils in this survey area.

Agronomy

According to the 1989 Montana Agricultural Statistics publication, there are roughly 95,000 acres of cropland in the survey area. Of this amount, approximately 33,000 acres are hayland and nearly 36,000 acres are irrigated cropland. About two-thirds of the hayland is irrigated. Almost 6,000 acres of annual cropland are under irrigation. The Helena Valley and Augusta areas comprise the major crop-producing areas of the survey area. The main annual crops include winter wheat, spring wheat, and barley. Perennial forages grown are mainly grass-legume and alfalfa hay. Some oats and barley are also grown for hay.

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider obtaining specific information from local Natural Resources Conservation Service or Cooperative Extension Service offices.

Cropland Limitations and Hazards

Management concerns affecting the use of the detailed soil map units in the survey area for crops are shown in the table, “Main Cropland Limitations and Hazards.” The main concerns in managing nonirrigated cropland are conserving moisture, controlling soil blowing and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the water infiltration rate. Applying conservation tillage and conservation-cropping systems, establishing field windbreaks, farming on the contour, leaving crop residue on the surface, and stripcropping conserve moisture.

Generally, a combination of several practices is needed to control *soil blowing* and *water erosion*. Conservation tillage, stripcropping, field windbreaks, tall grass barriers, contour farming, conservation-cropping systems, crop-residue management, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green-manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the limitations and hazards shown in the table cannot be easily overcome. These are *channels, flooding, depth to rock, ponding, gullies,* and *lack of timely precipitation*.

Additional limitations and hazards are as follows:

Areas of rock outcrop and slickspots—Farming around these areas may be feasible. Subsoiling or deep ripping soft sedimentary beds increases the effective rooting depth and the rate of water infiltration.

Excessive permeability—This limitation causes deep leaching of nutrients and pesticides. The capacity of the soil to retain moisture for plant use is poor.

Lime content, limited available water capacity, poor tilth, restricted permeability, and *surface crusting*—These limitations can be overcome by incorporating green-manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. In addition, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

Potential for ground-water pollution—This limitation is a hazard in soils with excessive permeability, hard bedrock, or a water table within the profile.

Short frost-free period—If the growing season is less than 90 days, short-season crops or grasses should be grown.

Slope—Where the slope is more than 8 percent, soil blowing and water erosion may be accelerated unless conservation-farming practices are applied.

Surface rock fragments—This limitation causes rapid wear of tillage equipment; it cannot be easily overcome.

Surface stones—Stones or boulders on the surface can hinder normal tillage unless they are removed.

Salt and sodium content—In areas where this is a limitation, only salt- and sodium-tolerant crops should be grown.

On irrigated soils, the main management concerns are *efficient water use, nutrient management, control of erosion, pest and weed control*, and *timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Overirrigation can also create drainage problems, raise the water table, and increase soil salinity.

Following is an explanation of the criteria used to determine the limitations or hazards.

Areas of rock outcrop—Rock outcrop is a named component of the map unit.

Areas of rubble land—Rubble land is a named component of the map unit.

Areas of slickspots—Slickspots are a named component of the map unit.

Channeled—The word “channeled” is included in the name of the map unit.

Depth to rock—Bedrock is within a depth of 40 inches.

Excessive permeability—The upper limit of the permeability range is 6 inches or more within the soil profile.

Flooding—The component of the map unit is occasionally flooded or frequently flooded.

Gullied—The word “gullied” is included in the name of the map unit.

Lack of timely precipitation—The component of the map unit has a xeric moisture regime, and the amount of annual precipitation is no more than 14 inches.

Lime content—The component is assigned to wind erodibility group 4L or has more than 5 percent lime in the upper 10 inches. Wind erodibility groups are defined in the “Soil Properties” section.

Limited available water capacity—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 5 inches or less.

Ponding—Ponding duration is assigned to the component of the map unit.

Poor tilth—The component of the map unit has more than 35 percent clay in the surface layer.

Potential for ground-water pollution—The soil has a water table within a depth of 4 feet or hard bedrock within the profile, or permeability is more than 6 inches per hour within the soil.

Restricted permeability—Permeability is 0.06 inch per hour or less within the soil profile.

Salt content—The component of the map unit has an electrical conductivity of more than 4 in the surface layer or more than 8 within a depth of 30 inches.

Short frost-free period—The map unit has a growing season of less than 90 frost-free days.

Slope—The upper slope range of the component of the map unit is more than 8 percent.

Sodium content—The sodium adsorption ratio of the component of the map unit is more than 13 within a depth of 30 inches.

Soil blowing—The wind erodibility index multiplied by the selected high C factor for the survey area and then divided by the T factor is more than 8 for the component of the map unit.

Surface crusting—The sodium adsorption ratio in the surface layer is 5 or more for any texture and 4 or more if the texture is silt, silt loam, loam, or very fine sandy loam.

Surface rock fragments—The terms describing the texture of the surface layer include any rock fragment modifier except for gravelly or channery, and “surface stones” is not already indicated as a limitation.

Surface stones—The terms describing the texture of the surface layer include any stony or bouldery modifier or the soil is a stony or bouldery phase.

Water erosion—The surface K factor multiplied by the upper slope limit is more than 2 (same as prime farmland criteria).

Water table—The component of the map unit has a water table within a depth of 60 inches.

Crop Yield Estimates

The average yields per acre that can be expected of the principal crops are shown in the table, “Land Capability and Yields per Acre of Crops and Pasture.” In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit is shown in the table.

The nonirrigated small grain yields presented are a maximum potential estimated using a crop yield model based on Montana Agricultural Experiment Station Special Report Number 35 (Brown and Carlson, 1990). Basic model assumptions include soil moisture at field capacity to 40 inches, a 70 percent

annual precipitation probability as published by the National Climatic Center, fertilization to yield, and full pest and weed control. Irrigated small grain yields are not provided. The model has been validated with collected yield data.

Forage crop yields are estimates based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management practices can include improving drainage; controlling erosion; protecting areas from flooding; selecting proper planting and seeding rates; choosing suitable high-yielding crop varieties; appropriately and timely tilling; controlling weeds, plant diseases, and harmful insects; ensuring favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effectively using crop residue, barnyard manure, and green-manure crops; and harvesting to ensure the smallest possible loss.

For provided irrigated crop yields, it is assumed that the irrigation system is adapted to the soils and to the forage crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Pasture and Hayland Management

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

Yield estimates are often indicated in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about forage yields other than those shown in the table, “Land Capability and Yields per Acre of Crops and Pasture.”

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, as described in “Land Capability Classification” (U.S. Department of Agriculture, 1961), soils generally are grouped at three levels: capability class, subclass, and unit. These levels indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grains, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and forestland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 5. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are

suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7. Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide guidance on the use of these soils as cropland.

Areas in class 8 are generally not suitable for cropland, pasture, or forestland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses indicate the dominant limitations in the class. These subclasses are designated by adding a letter, *E, W, S*, or *C*, to the class numeral, for example, 2E. The letter *E* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *W* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *S* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *C*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *W, S*, or *C* because the soils in class 5 are subject to little or no erosion. Class 5 soils have other limitations that restrict their use mainly to pasture, rangeland, forestland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the table, “Land Capability and Yields per Acre of Crops and Pasture,” at the end of this section.

Prime Farmland and Other Important Farmland

In this section, prime farmland and other important farmland are defined. The soils in the survey area that are considered prime farmland are listed in the table, “Prime and Important Farmland,” at the end of this section.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pasture, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

About 26,100 acres, or nearly 6 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

The map units in the survey area that are considered prime farmland are listed in the “Prime and Important Farmland” table. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. The need for these measures is indicated in parentheses after the map unit name. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in the “Acreage and Proportionate Extent of the Soils” table. The location

is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section “Soil Series and Detailed Soil Map Units.”

Unique Farmland

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil qualities, location, growing season, and moisture supply needed for the economic production of sustained high yields of a specific high-quality crop when treated and managed by acceptable farming methods. Examples of such crops are citrus, cranberries, olives, tree nuts, and vegetables.

Unique farmland is used for a specific high-value food or fiber crop; has an adequate supply of available moisture for the specific crop because of irrigation, precipitation, and stored moisture; and has a combination of soil qualities, growing season, temperature, humidity, air drainage, elevation, aspect, and other factors, such as nearness to markets, that favors the production of a specific food or fiber crop.

Lists of unique farmland are developed as needed in cooperation with conservation districts and others.

Additional Farmland of Statewide Importance

Some areas other than areas of prime and unique farmland are of statewide importance in the production of food, feed, fiber, forage, and oilseed crops. The criteria used in defining and delineating these areas are determined by the appropriate state agency or agencies. Generally, additional farmland of statewide importance includes areas that nearly meet the criteria for prime farmland and that economically produce high yields of crops when treated and managed by acceptable farming methods. Some areas can produce as high a yield as areas of prime farmland if conditions are favorable. In some states, additional farmland of statewide importance may include tracts of land that have been designated for agriculture by state law.

Farmland of statewide importance is included in the list of prime farmland. Criteria is available in the “Montana Field Office Technical Guide” (U.S. Department of Agriculture, Natural Resources Conservation Service, Section II).

Additional Farmland of Local Importance

This land consists of areas that are of local importance in the production of food, feed, fiber, forage, and oilseed crops and are not identified as having nationwide or statewide importance. Where appropriate, this land is identified by local agencies. It may include tracts of land that have been designated for agriculture by local ordinance.

Lists of this land are developed as needed in cooperation with conservation districts and others.

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices.

Soil Erodibility (K) Factor

The soil erodibility factor (K) indicates the susceptibility of a soil to sheet and rill water erosion. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand; the content of sand coarser than very fine sand; and the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the revised Universal Soil Loss Equation. Kf factor shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance factor (T) is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used,

depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index factor (I) is determined. This factor is an expression of the stability of the soil aggregates or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter. Wind erodibility groups are defined in the "Soil Properties" section.

Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide additional information about wind erodibility groups and K, Kf, T, and I factors.

Windbreaks and Environmental Plantings

Windbreaks protect buildings, cropland, fruit trees, gardens, livestock, and yards from wind and snow; help to keep snow on fields; and provide food and cover for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well-prepared site and maintained in good condition.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of planted trees that have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The "Windbreak Suitability Groups Species List" table shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table are based on measurements and observations of established plantings that have been given adequate care. They can be used as a guide in planning screens and windbreaks. Additional information on planning screens and windbreaks and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards or limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same.

Group 1 consists of soils that have no soil-related hazards or limitations or only slight hazards or limitations if they are used for windbreaks. Slopes are less than 15 percent.

Group 2M consists of soils that have a moderate available water capacity (5 to 10 inches) because of texture, depth, or both. The soils are well drained and not affected by salinity. A layer of concentrated lime, if it occurs, is below a depth of 24 inches. Slopes are less than 15 percent.

Group 2L consists of soils that have a layer of concentrated lime (more than 15 percent calcium carbonate equivalent) at a depth of about 15 to 24 inches. Available water capacity is at least 5 inches. Soils are well drained and not affected by salinity or alkalinity. (Electrical conductivity is less than 4 millimhos per centimeter.) Slopes are less than 15 percent.

Group 2W consists of soils that have an available water capacity of 5 inches or more. If the soils have a layer of concentrated lime, the layer is below a depth of 15 inches. Depth to a permanent water table is 30 to 60 inches. Soils are not affected by salinity. Slopes are less than 15 percent.

Group 2S consists of soils that are moderately affected by salinity. (Electrical conductivity is 4 to 12 millimhos per centimeter.) Available water capacity

is at least 5 inches. A layer of concentrated lime, if it occurs, is at a depth of 15 inches or more. The water table is at a depth of 30 inches or more. Slopes are less than 15 percent.

Group 3M consists of soils that have an available water capacity of 2 to 5 inches because of texture, depth, or both. A layer of concentrated lime, if it occurs, is at a depth of 15 inches or more. Soils are well drained and not affected by salinity. (Electrical conductivity is less than 4 millimhos per centimeter.)

Group 3L consists of soils that have a layer of concentrated lime (more than 15 percent calcium carbonate equivalent) at a depth of less than 15 inches. A permanent water table is at a depth of more than 30 inches. Available water capacity is more than 5 inches. Soils are not affected by salinity. (Electrical conductivity is less than 4 millimhos per centimeter.) Slopes are less than 15 percent.

Group 3W consists of soils that have an available water capacity of 2 inches or more. If the soils have a layer of concentrated lime, the layer is below a depth of 15 inches. Depth to a permanent water table is 30 inches or less. The water table is more than 10 inches during all or most of the growing season. Soils are not affected by salinity. Slopes are less than 15 percent.

Group 3S consists of soils that are severely affected by salinity or alkalinity. (Electrical conductivity is 12 to 16 millimhos per centimeter.) Available water capacity is 5 inches or more. A layer of concentrated lime, if it occurs, is at a depth of more than 15 inches. A permanent water table is at a depth of 30 inches or more. Slopes are less than 15 percent.

Group 4 consists of soils that have slopes of more than 15 percent, except for soils in areas where the length of the slopes is 100 feet or less and the less sloping soils have very severe limitations, including soils that have a very low available water capacity (2 inches or less); very shallow, stony, or gravelly soils; strongly saline and alkali soils, in which the electrical conductivity is more than 16 millimhos per centimeter; and soils that have a pH of more than 9.0. Rock outcrop is also in this group.

Range

Livestock grazing is the dominant land use in the Lewis and Clark County Area. Nearly 80 percent of nonfederal land in the county is rangeland or grazeable woodland. In 1985, this survey area provided forage for nearly 24,000 cow-calf pairs and 8,000 sheep with lambs. Livestock, primarily cow-calf operations, accounted for nearly 78 percent of the farm income in the county. Ranch sizes vary from 1,000 acres to 100,000 acres, with the majority in the 8,000- to 12,000-acre range. Most grazing is in native range. Before livestock are released onto the native range, some ranchers use introduced species, such as crested wheatgrass, for early spring grazing. Some of the summer grazing is on federal land administered by the U.S. Forest Service and the Bureau of Land Management.

The range is used primarily for grazing domestic livestock. However, it also is used as wildlife habitat, recreational areas, and watershed, and it has aesthetic value.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on range are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Rangeland is defined as land on which the historic climax plant community is predominantly grasses, grasslike plants, forbs, or shrubs. Rangeland includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Rangeland includes natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows (U.S. Department of Agriculture, 1976).

The composition and production of the plant community are determined by soil, climate, topography, overstory canopy, and grazing management.

Grazeable forestland is defined as land on which the understory includes, as an integral part of the forest plant community, plants that can be grazed without significant impairment of other forest values.

Native and naturalized pasture are defined as forestland and naturalized open areas, other than rangeland, that are used primarily for the production of forage for grazing by livestock and wildlife. Overstory trees, if present, are managed to promote naturally occurring native and introduced understory forage species located on the site (U.S. Department of Agriculture, 1976).

The table, “Rangeland and Grazeable Understory—Productivity and Characteristic Plant Communities,” shows, for each listed soil, the ecological site (rangeland ecological site or representative habitat type); the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic native vegetation; and the average percent composition of each species. Only those soils that are used as rangeland or grazeable forestland, or are suited to use as rangeland or grazeable forestland, are listed. Explanation of the column headings in this table follows.

Ecological site includes rangeland ecological site and representative habitat type as defined below.

Rangeland ecological site is a distinctive kind of rangeland with specific physical characteristics, which differs from other kinds of rangeland in its ability to produce a distinctive kind and amount of vegetation (U.S. Department of Agriculture, 1976).

Many different ecological sites are in the survey area. Over time, the combination of plants best suited to a particular soil and climate has become established. If the soil is not excessively disturbed, this group of plants is the natural plant community for the site. Natural plant communities are not static but vary slightly from year to year and place to place.

The relationship between soils and vegetation was ascertained during this survey; thus, ecological sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important. The “Montana Field Office Technical Guide,” (U.S. Department of Agriculture, Natural

Resources Conservation Service, Section II) available at local offices of the Natural Resources Conservation Service, can provide specific information about rangeland ecological sites.

Representative habitat type is an aggregation of all land areas capable of producing similar climax plant communities. Habitat types are considered basic ecological subdivisions of landscapes. Each is recognized by distinctive combinations of overstory and understory plant species at climax. They are named for the dominant or characteristic vegetation of the climax community. Habitat types are useful in soil surveys when assessing the combined effects of aspect, slope, elevation, and soil properties on potential plant growth. The representative habitat type or phase displayed in this table is documented in the “Forest Habitat Types of Montana” (Pfister and others, 1977).

Total annual production is the amount of vegetation that can be expected to grow annually on well-managed range that is supporting the historic climax plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year’s growth of leaves, twigs, and fruit of woody plants up to a height of 4.5 feet. Total annual production does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation, along with temperature, make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic native vegetation consists of the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil. The plants are listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. For grazed forestland, the table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of forestland in which the production of wood crops is highest.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Similarity Index

Similarity index, one method to evaluate an ecological site, compares the present plant community to the historic climax plant community for that site or to a desired plant community that is one of the site’s potential vegetation states. The similarity index to the historic climax plant community is the percentage, by weight, of historic climax vegetation present on the site. Likewise, a similarity index to a desired plant community is the percentage, by weight, of the desired plant community present on the site. As the name implies, this method assesses the similarity of the plant community to the historic climax or desired plant community. The similarity index can provide an indication of past disturbances, as well as future management or treatment, or both, needed to achieve the client’s objectives (U.S. Department of Agriculture, 1976).

Abnormal disturbances that change the natural plant community include repeated overuse by livestock, excessive burning, erosion, and plowing. Grazing animals select the most palatable plants within a community. These plants will eventually die if they are continually grazed. A very severe disturbance can destroy the natural community. Under these conditions, less desirable plants, such as annuals and weeds, can invade. If the plant community has not deteriorated significantly, it eventually can return to dominantly natural plants if proper grazing management is applied.

Knowledge of the ecological site and the similarity index is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to determine management objectives, proper grazing systems and stocking rates, suitable wildlife management practices, potential for recreational uses, and condition of watersheds.

Rangeland Management

Rangeland management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires knowledge of the similarity index for the ecological site.

The objective in grazing land management is to provide the kind of plant community that provides for and maintains a healthy ecosystem, produces quality forage for the grazing animals, and meets the needs of the grazing land enterprise and the desires of the landowner (U.S. Department of Agriculture, 1976). Proper grazing management generally results in the optimum production of vegetation, reduction of less desirable species, conservation of water, and control of erosion. Sometimes, however, a similarity index percentage somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Grazing management is the most important part of any rangeland management program. Proper grazing use, timely deferment of grazing, and planned rotation grazing systems are key practices. The experience of ranchers and research has shown that if no more than one-half of the current year's growth is grazed, a plant community in good or excellent condition can be maintained, and one in fair condition can be improved. The remaining one-half enables plants to make and store food for regrowth and root development. As a result, the desirable plants remain healthy and are not replaced by less desirable grasses and weeds. Also, the plant cover protects the soil from water erosion and soil blowing, increases moisture retention, improves tilth, increases the rate of water infiltration, and helps to control runoff.

Certain practices commonly are needed to obtain a uniform distribution of grazing. These practices include developing livestock watering facilities, fencing, properly locating salt and mineral supplements, constructing livestock trails in steeply sloping areas, and riding or herding.

Various kinds of grazing systems can be used in range management. No single grazing system is best under all conditions. The grazing system should increase the quantity and improve the quality of the range vegetation; should meet the needs of the individual operator; and should be designed according to topography, type of grazing animals, and resource management objectives.

Special improvement practices are needed in areas where management practices do not achieve the desired results or where recovery is too slow under forage management alone. These practices include range seeding, brush management, water spreading, prescribed burning, and mechanical treatment.

Some soils are suited to mechanical treatment for range improvement. On other soils, however, only proper grazing management can improve the range. The “Agronomy” section defines capability classes. They are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. Many soils in capability classes 1 through 4 are suited to such practices as seeding, mechanical brush and weed control, and water spreading. Those soils in capability classes 7 and 8, however, are not suitable. Many soils in capability classes 1 through 4 are suited to tillage for seedbed preparation before native or introduced forage plant species are seeded. Soils in capability class 6 may be suited to limited surface disturbance, such as scarification, for seeding and as a means of increasing the rate of water infiltration for seed germination.

Where feasible, mechanical renovation practices, such as shallow chiseling, can help to speed recovery of the desired plants. These practices open up the surface and thus allow absorption of more moisture and production of more desirable plants. Mechanical renovation, brush management, and timely deferment of grazing allow recovery of desired plants.

Seeding may be needed in areas where less desirable plants are dominant. A clean, firm seedbed should be prepared, suitable species should be selected for seeding, and rest periods should be long enough to allow the new plants to become established. Special improvement practices can be effective only if the management system helps to keep the desirable plants healthy.

Understory Management

Understory vegetation consists of grasses, forbs, shrubs, and other plants. If well managed, some forestland can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

Forest understory production can be influenced by controlling canopy density in addition to the management of stocking rates, distribution, and season of use. Often both the woodland and range resources can be enhanced through thinning the overstory to canopy levels that optimize both timber and forage production. Broadcast seeding of disturbed areas soon after timber harvest can improve forage quantity and quality and reduce

the chances of undesirable plants occupying the site.

Steepness of slopes and distance to drinking water are severe grazing management problems in much of the mountain and foothill areas. Variations in primary season of use, production levels, and plant communities because of elevation and aspect changes present additional challenges. Long, steep slopes provide limited access to livestock. Less sloping areas are subject to overuse. Grazing should be delayed until the soil is firm enough to withstand trampling and the plants have matured enough to withstand grazing pressure.

Riparian areas should be protected from overuse by livestock. Misuse results in deterioration of protective vegetation, reduction of streambank stability, and excessive erosion. Developing off-stream-watering locations can successfully prevent cattle from overgrazing riparian areas and encourage better livestock distribution.

Forestland

Forest managers can use the “Forestland Management” and “Forestland Productivity” tables to plan the use of soils for wood crops. Only those soils suitable for wood crops are listed.

Woodland Ordination System

The “Forestland Management” table lists the ordination (woodland suitability) symbol for each soil. The ordination system is a nationwide uniform system of labeling soils or groups of soils that are similar in use and management. The primary factors evaluated in the woodland ordination system are productivity of the forest overstory tree species and the principal soil properties resulting in hazards and limitations that affect forest management. There are three parts of the ordination system—class, subclass, and group. The class and subclass are referred to as the ordination symbol.

Ordination Class Symbol

The first element of the ordination symbol is a number that denotes potential productivity in terms of cubic meters of wood per hectare per year for the indicator tree species; the larger the number, the greater the potential productivity. Potential productivity is based on site index and the corresponding culmination of mean annual increment. For example, the number 1 indicates a potential production of 1 cubic meter of wood per hectare per year (14.3 cubic feet per acre per year), and 10 indicates a potential production of 10 cubic meters of wood per hectare per year (143 cubic feet per acre per year).

Indicator species is a species that is common in the area and is generally, but not necessarily, the most productive on the soil. It is the species that determines the ordination class. In the “Forestland Productivity” table, an indicator species is the first species listed for a particular map unit. This table shows the productivity for all species where data have been collected.

Site index is determined by taking height measurements and determining the age of selected trees within stands of a given species (Alexander, 1966). This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands. The site indexes shown in the “Forestland Productivity” table are averages based on measurements made at sites that are representative of the soil series. When the site index and forestland productivity of different soils are compared, the values for the same tree species should be compared (Dahms, 1964). The higher the site index number, the more productive the soil for that species. Site index values are used in conjunction with yield tables (Myers, 1967) to determine mean annual yields. Indirectly, they are used to determine the productivity class in the ordination class symbol.

Ordination Subclass Symbol

The second element, or subclass, of the ordination symbol is a capital letter that indicates certain soil or physiographic characteristics that contribute to important hazards or limitations to be considered in management. The subclasses are defined as follows:

Subclass X indicates that forestland use and management are limited by stones or rocks.

Subclass W indicates that forestland use and management are significantly limited by excess water, either seasonally or throughout the year. Restricted drainage, a high water table, or flooding can adversely affect either stand development or management.

Subclass T indicates that forestland use and management are limited by a root zone that has toxic substances. Excessive alkalinity, acidity, sodium salts, or other toxic substances impede the development of desirable species.

Subclass D indicates that forestland use and management are limited by a restricted rooting depth. The rooting depth is restricted by hard bedrock, a hardpan, or other restrictive layers in the soil.

Subclass C indicates that forestland use and management are limited by the kind or amount of clay in the upper part of the soil.

Subclass S indicates that forestland use and management are limited by sandy soil, a low available water capacity, and a normally low content of available plant nutrients. The use of equipment is limited during dry periods.

Subclass F indicates that forestland use and management are limited by a high content of rock fragments that are larger than 2 millimeters and smaller than 10 inches. This subclass includes flaggy soils.

Subclass R indicates that forestland use and management are limited by excessive slope.

Subclass A indicates that no significant limitations affect forestland use and management.

Forestland Management and Productivity

Information about the management and productivity of the forested map units in the survey area is given in the “Forestland Management” and “Forestland Productivity” tables.

Management Concerns

In the “Forestland Management” table, the soils are rated for erosion hazard, equipment limitation, seedling mortality, windthrow hazard, and plant competition.

Erosion hazard is *slight* if there is little or no hazard of erosion, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive soil loss.

Equipment limitation is *slight* if the use of equipment is not limited to a particular kind of equipment or time of year; *moderate* if there is a short seasonal limitation or a need for some modification in the management of equipment; and *severe* if there is a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings are for seedlings from good planting stock that are properly planted during a period of average rainfall. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Windthrow hazard is *slight* if trees in wooded areas are not expected to be blown down by commonly occurring winds, *moderate* if some trees are blown down during periods of excessive soil wetness and strong winds, and *severe* if many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Plant competition is *slight* if there is little or no competition from other plants; *moderate* if plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and *severe* if plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

Potential Productivity

The potential productivity of merchantable or *common trees* is expressed as a site index, which is described under the heading “Ordination Class Symbol.” Commonly grown trees are those that forestland managers generally favor in intermediate or improvement cuttings. They are selected based on growth rate, quality, value, and marketability.

The column, *Trees that stands are commonly managed for,* in the “Forestland Productivity” table lists trees that are suitable for commercial wood production and that are suited to the soils.

Main Forest Access Road Limitations and Hazards

The major management concerns affecting the use of the detailed soil map units in the survey area for forest access roads are listed in the “Main Forest Access Road Limitations and Hazards” table. The significance of each limitation or hazard and the criteria used to determine the limitation or hazard are described in this section.

Areas of rock outcrop and *depth to bedrock* can increase the cost of road construction and influence route planning. Constructing roads is difficult because of the need for rock removal and the need for additional soil material to provide a suitable road surface.

Boulders increase the cost of road construction and influence route planning. Construction is difficult mainly because of the need for extraction and disposal of the boulders.

Dustiness of the road surface material may cause safety problems and accelerate equipment wear. Dust-abatement measures are needed during dry periods.

Flooding in the area where a road is constructed may restrict use, result in damage to the roadway, and result in the sedimentation of waterways. The

hazard of flooding can be reduced by installing a drainage system, elevating the roadbed, and using riprap and diversions.

Low soil strength of the soil material used to construct the road surface can result in rutting, in drainage problems, and in poor trafficability during wet periods. The road should be used only during dry periods or when the surface is frozen. Surfacing with material of suitable strength and installing a drainage system can help to overcome this limitation.

Roadbed material that has a high *shrink-swell potential* shrinks and swells markedly during dry and wet periods. Excessive shrinking and swelling can damage the road surface or other features, such as bridge abutments, culverts, and erosion-control structures.

A steep *slope* results in increased construction and maintenance costs and increased sedimentation because of the large cuts necessary to create an adequate roadbed. Seeding the cut slope to suitable vegetation minimizes sedimentation. Large cuts can increase instability of the slope. Where slumping is a hazard, slope failure can become a significant maintenance and environmental problem.

Slumping causes safety problems and increases maintenance costs. Frequent clearing of slumped soil in the roadbed or rebuilding of the roadway may be needed to keep the road serviceable and drainage systems functioning.

Stones cause problems in maintaining a smooth road surface that has good trafficability. Unless the stones are removed, additions of suitable stone-free material may be needed when the road is surfaced.

The erodibility of the soil material in the roadbed influences the probability of *water erosion* resulting from the channeling of runoff in the roadway. Erosion can result in the sedimentation of streams. It can be controlled by reducing road grades and controlling runoff onto and off of the road surface through the installation of drainage measures.

Roads built across soils that have a *water table* may require substantial ballast, fabric, internal drainage systems, and other measures that maintain a road surface that has good trafficability. Construction and use of the road only during periods when the water table is not near the surface or when the road is frozen help to maintain trafficability and reduce the potential for site damage.

Following is an explanation of the criteria used to determine the limitations or hazards.

Areas of rock outcrop—Rock outcrop is a named component of the map unit.

Areas of rubble land—Rubble land is a named component of the map unit.

Boulders—The terms describing the texture within a depth of 24 inches include a bouldery modifier, or the soil is a bouldery phase.

Depth to rock—Hard bedrock is within a depth of 60 inches.

Dustiness—The surface layer is silt, silt loam, loam, or very fine sandy loam.

Flooding—The component of the map unit is occasionally flooded or frequently flooded.

Low soil strength—The component of the map unit has one of the following Unified classifications (ASTM, 1988) within the 60-inch profile: ML, CL, MH, CH, OL, PT, or GC.

Shrink-swell potential—The component of the map unit has a high shrink-swell potential in a layer that is at least 10-inches thick and is within 40 inches of the surface.

Slope—The upper slope limit is more than 35 percent.

Slumping—The component of the map unit meets the requirements for low soil strength and has slopes of more than 35 percent.

Stones—The terms describing the texture within a depth of 24 inches include a very stony or extremely stony modifier or the soil is a very stony or extremely stony phase.

Water erosion—The surface K factor multiplied by the upper slope limit is more than 10.

Water table—The component of the map unit has a water table within a depth of 60 inches.

Forestland in the Lewis and Clark County Area

Approximately 390,000 acres, or roughly 32 percent, of the survey area are forested. Roughly 60 percent, or 235,000 acres, is considered commercial, and about 40 percent, or 155,000 acres, is considered noncommercial (O'Brien, 1991). The commercial forestland is generally of low productivity and produces 20 to 50 cubic feet per acre per year. In 1989, net volume of sawtimber was estimated to be 1,106 million board feet; 98 percent of which was softwood timber. Most of the estimated timber volume was on private land, accounting for approximately 92 percent of the total volume (Mont. Dept. of State Lands, 1984). Small tree diameters and low productivity of the area limit the sawtimber volume available. Forested areas to the west of the Continental Divide are more productive than areas to the east.

The survey area has provided a limited amount of tree harvesting in the past and has potential to do so

in the future. During 1988, about 8.2 million board feet of sawtimber were cut from timberland outside the national forest. Of this, about 86 percent, or 7 million board feet, was on nonindustrial private forestland, and about 14 percent, or 1.2 million board feet, was on forest industry land and public land (Mont. Dept. of State Lands, 1984). Net annual growth of sawtimber is about 35.8 million board feet (O'Brien, 1991).

Fire protection for forested land is provided by the Department of State Lands, Division of Forestry; U.S. Forest Service; and local fire districts.

Expected tree growth rate and tree diversity on a site are determined by a combination of elevation, aspect, soils, and climate. The ability of soils to support tree growth is dependent on variability in soil depth, fertility, texture, and available water capacity. Forested soils in the area range from shallow to very deep, nongravelly to extremely gravelly, fine textured to coarse textured, and those containing no lime to those containing high amounts of lime.

The major component of coniferous forestland is in the mountains and foothills in the western part of the area. Principal trees are Douglas-fir, ponderosa pine, limber pine, whitebark pine, lodgepole pine, quaking aspen, Engelmann spruce, white spruce, and subalpine fir. Douglas-fir trees comprise the largest amount of acreage. A small amount of cottonwood trees (plains cottonwood, western black cottonwood, and narrowleaf cottonwood) are on soils that formed in alluvium along major stream drainages.

Stands of limber pine, ponderosa pine, and Douglas-fir are also at lower elevations in the survey area. South of Highway 200, ponderosa pine is the forest type most frequently on the lowest elevation foothill sites. North of Highway 200, Douglas-fir and limber pine are the forest components at the lowest elevations. Ponderosa pine is absent. As elevation and precipitation increase, Douglas-fir becomes the dominant component of the overstory. Soil series in these areas are mainly Beartooth, Elbeth, Mocmont, Sawbuck, Tolex, Trapps, Warneke, Whitecow, and Woodgulch. Major forest understory vegetation consists of arrowleaf balsamroot, bluebunch wheatgrass, elk sedge, heartleaf arnica, Idaho fescue, pinegrass, rough fescue, spike trisetum, and white spiraea.

Douglas-fir is the main tree species on south-facing aspects at elevations around 5,500 feet and above. A mixture of Douglas-fir and lodgepole pine are found on north, west, and east aspects. Lodgepole pine is found in valleys at the lower elevations, west of the Continental Divide. Spruce trees are also in valleys on cool, north aspects west of the Continental Divide. At the highest elevations, around 7,000 feet, small amounts of whitebark pine are near the Continental Divide. The main soils supporting trees in these cool, mountainous areas at high elevations are Cowood, Helmville, Mikesell, Stemple, Swiftcurrent, Tigeron, Tropal, Whitore, and Worock. The main understory plants are pinegrass, common beargrass, white spiraea, heartleaf arnica, blue huckleberry, grouse whortleberry, twinflower, and common snowberry.

Some quaking aspen are in mountain footslopes and small mountain valleys at approximate elevations of 5,000 feet. Soils in these areas have high available water capacity and occur in areas receiving extra moisture from run-in. The main soil in these areas is the Bridger series.

Listed below is information pertaining to the development of forestland tables in the area. Site index ratings were developed using the following references: Douglas-fir (Brickell, 1968), Engelmann spruce (Alexander, 1967), lodgepole pine (Alexander, 1966), ponderosa pine (Meyer, 1938), and quaking aspen (Baker, 1925).

Productivity ratings were made based on timber being harvested by the clear-cut method and slash burned. It is assumed that reasonable care was used in logging, so that funneling of skid trails did not occur to concentrate the water; excessive disturbance did not occur; and coarser material from slash disposal remained.

Equipment limitations were related to logging operations. Of prime consideration were difficulties encountered in yarding logs and the influence of logging activities on soil properties. Primary soil features considered for this rating were slope, soil texture, soil depth, seasonal soil wetness, and stoniness.

Seedling mortality ratings apply to planting stock 1 or 2 years of age, with the evaluation period beginning at the time of planting. For natural regeneration, the evaluation period was considered to begin a year after germination.

Windthrow hazard ratings were developed as follows:

Soils on north slopes that remain moist into the spring, and those having a high basal area to limit root development, were considered moderately prone to windthrow even though the soil materials provided

a good anchoring medium for tree roots. On drier sites, clayey soils without rock fragments were also considered in this category.

Soils having a high water table (within 20 inches of the surface) long enough to inhibit root development were considered to be severely susceptible to windthrow.

When making ratings for plant competition, the limitation was considered slight if adequate regeneration usually occurs on a soil within 5 years.

For most species, overstory yield estimates were determined from the average annual yield versus site index curves. These curves were developed by adjusting data presented in yield tables published from several different sources. Average annual yield values were computed at the culmination of mean annual increment. Total cubic-foot-volume estimates are based on trees that are more than 4-inch diameter breast height.

“Even-aged Stands of Ponderosa Pine” (Meyer, 1938) was used for estimating yields of Douglas-fir and ponderosa pine. Board-foot volumes are based on Scribner’s log rule and include all trees larger than 10-inch diameter breast height to an 8-inch top diameter inside bark (Dahms, 1964). “Aspen in the Central Rocky Mountain Region” (Baker, 1925) was used to estimate quaking aspen yields.

Recreation

Soils of the survey area are rated in the "Recreational Development" table according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. Soils are rated based on soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. Soils are rated based on soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. Soils are rated based on soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. These areas should require little or no cutting and filling during site preparation. Soils are rated based on soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, not dusty when dry, and not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal

high water table. These limitations generally require major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

The information in the “Recreational Development” table can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the “Building Site Development” table and interpretations for septic tank absorption fields in the “Sanitary Facilities” table.

Wildlife

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Elements of Wildlife Habitat

The following paragraphs describe the elements of wildlife habitat.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples of these crops grown in the survey area are barley, oats, rye, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples of grasses and legumes in the survey area are alfalfa, brome, clover, crownvetch, fescue, orchardgrass, reed canarygrass, timothy, and trefoil.

Wild herbaceous plants are native or naturally established forbs and grasses, including weeds, that provide food and cover for wildlife. Examples of wild herbaceous plants in the survey area are blackberry, blueberry, bluestem, dandelion, fescue, goldenrod, Indiangrass, lambsquarters, nightshade, ragweed, and wheatgrass.

The major soil properties affecting the growth of forage and grain crops and wild herbaceous plants are amount of water available to plants, depth of the root zone, flooding, salinity or sodicity, texture of the surface layer, and wetness. The length of the growing season also is important.

Deciduous trees and woody understory produce bark, buds, catkins, foliage, nuts or other fruit, and twigs that wildlife eat. Examples of deciduous trees and woody understory in the survey area are American elm, birch, boxelder, green ash, maple, oak, poplar, and willow. Examples of fruit-producing shrubs in the survey area are American plum, chokecherry, crabapple, hawthorn, honeysuckle, redosier dogwood, serviceberry, and silver buffaloberry.

Coniferous plants are cone-bearing trees, ground covers, or shrubs that provide habitat or supply food in the form of browse, fruitlike cones, or seed. Examples of coniferous plants in the survey area are cedar, fir, hemlock, juniper, larch, pine, spruce, and yew.

The major soil properties affecting the growth of coniferous and deciduous trees and shrubs are amount of water available to plants, depth of the root zone, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of wetland plants in the survey area are arrowhead, bulrush, cattail, millet, pickerelweed, rush, sedge, smartweed, waterplantain, and wildrice.

The major soil properties affecting wetland plants are acidity or alkalinity, slope, texture of the surface layer, and wetness.

Shallow-water areas have an average depth of less than 5 feet. These areas, either naturally wet or created by dams, levees, or water-control measures in marshes or streams, are useful as habitat for some wildlife species. Examples of shallow-water areas in the survey area are beaver ponds and other wildlife ponds, muskrat marshes, waterfowl feeding areas, and wildlife watering developments.

The major soil properties affecting shallow-water areas are depth to bedrock, permeability, slope, surface stoniness, and wetness.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, meadows, pasture, and other areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to openland areas include cottontail rabbit,

field sparrow, Hungarian partridge, killdeer, meadowlark, pheasant, red fox, sage grouse, and sharp-tailed grouse.

Habitat for woodland wildlife consists of areas of coniferous or deciduous trees and shrubs or a mixture of these and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to woodland areas include black bear, deer, elk, owl, porcupine, raccoon, ruffed grouse, thrush, tree squirrel, wild turkey, and woodpecker.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow-water areas that support water-tolerant plants. Wildlife attracted to wetland areas include beaver, bittern, duck, geese, heron, kingfisher, mink, muskrat, otter, and rail.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland areas include antelope, deer, lark bunting, meadowlark, and sage grouse.

Wildlife of the Lewis and Clark County Area

Habitat quality and interspersion determine wildlife population levels. Suitability of a particular habitat for a wildlife species depends greatly on the nature of the plant communities present. Prevailing land-use practices and management determine the quantity, quality, and distribution of plant communities. These factors are governed to some extent by the soils of the area.

Rating soils for their ability to produce vegetative elements for wildlife habitat does not take into account local climatic influences, present use of soils, juxtaposition of habitat types or elements, or present distribution of wildlife species. For these reasons, the selection and suitability of an area for wildlife habitat development require onsite evaluation.

The survey area provides a variety of wildlife habitats, including coniferous forests, grassland prairies, irrigated and nonirrigated cropland, open woodlands, ponds, reservoirs, riparian wetlands and woodlands, rivers, and streams.

Rocky Mountain elk occur on foothill ranges in the western and southeastern portions of the survey area. They summer mostly on adjacent National Forest lands. Movement to lower elevation ranges begins in early to late fall depending on climatic conditions. Winter ranges generally consist of grassy, windblown ridges or south-facing slopes.

Both mule deer and white-tailed deer occupy the survey area. Mule deer occur over much of the brushy bottoms, foothills, rough rangeland, and wooded uplands. White-tailed deer generally inhabit the bottomlands of the Blackfoot, Dearborn, Missouri, and Sun Rivers and tributaries.

Pronghorn antelope occupy the prairie grasslands of the northeastern, south-central, and southeastern portions of the survey area.

Although limited by the areas they occupy, bighorn sheep and mountain goat occur along the Missouri River near the Gates of the Mountains Wilderness.

Moose and grizzly bear also inhabit the area. However, their ranges are essentially outside of the survey area. A few grizzly bear inhabit the footslopes of the Rocky Mountain Front south of the Sun River. Black bear inhabit forests and woodlands throughout the survey area.

Bottomlands of the Helena Valley and Sun River support habitat for ring-necked pheasant, an introduced species. Habitat includes brushy thickets, ditchbanks, fence rows, and irrigated and nonirrigated cropland.

Hungarian partridge, an introduced game bird from Europe, is associated with cropland and grassland areas of the northeastern and southeastern portions of the survey area. In the northeast, Hungarian partridge shares its range with sharp-tailed grouse. Sharp-tailed grouse occur throughout prairie uplands where brushy thickets and grain fields, with an abundance of fruit-bearing shrubs, such as buffaloberry, chokecherry, rose, and snowberry, provide quality habitat.

Three species of forest-dwelling grouse—blue, spruce, and ruffed—inhabit the coniferous forests and riparian woodlands of the survey area. A variety of habitats, such as brushy draws, mixed forests, and stream bottoms, are important to forest grouse throughout the seasons. Blue and spruce grouse winter at high elevations. In early spring, they descend to semi-open timber areas for breeding, nesting, and rearing of chicks.

Blue grouse habitat is closely associated with the distribution patterns of Douglas-fir and true fir and the soil associations that support forests with these species as components.

Ruffed grouse inhabit the dense cover of conifer and deciduous trees and shrubs, especially along stream courses. Adult ruffed grouse may spend most of their lives in an area of less than 2 square miles.

The Missouri River and the many marshes, ponds, potholes, reservoirs, rivers, and sloughs scattered throughout the survey area provide habitat for an abundance of waterfowl during spring and fall migrations and during the summer production period. Migratory birds use riverine habitat for feeding, nesting, and resting. Geese nest on the larger islands

of the Missouri River and use sparsely vegetated sandbars as feeding and resting areas.

Beaver, mink, and muskrat occur throughout the principal watercourses. Badger, bobcat, coyote, ground squirrel, and a variety of small mammals occupy the survey area.

Populations of game and nongame species can be enhanced by using conservation practices to improve their habitat. These practices include development of odd or irregularly shaped areas in and adjacent to farmland to provide food and cover, protection of habitat from fire or grazing, and establishment of woody vegetation to provide winter shelter. Wildlife habitat may also be enhanced through application of commonly employed conservation practices including minimum tillage, planned grazing systems, pond construction, shelterbelts and field windbreaks, and stripcropping.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. Ratings are based on observed soil performance and on estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

Additional interpretations can be made using the information in the tables, along with soil maps, soil descriptions, and other data provided in this survey.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

The "Building Site Development" table shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. Limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, open ditches, utility lines, and other purposes. Ratings are based on soil properties, site features, and observed soil performance. Ease of digging,

filling, and compacting is affected by the depth to bedrock, to a cemented pan, or to a very firm dense layer; stone content; soil texture; and slope. Depth to a seasonal high water table and susceptibility of the soil to flooding affect the time of year that excavations can be made. Soil texture and depth to the water table affect the resistance of the excavation walls or banks to sloughing or caving.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for dwellings without basements, dwellings with basements, and small commercial buildings without basements. Ratings are based on soil properties, site features, and observed soil performance. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. Ratings are based on soil properties, site features, and observed soil performance. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Ratings are based on soil properties, site features, and observed soil performance. Soil reaction; a high water table; depth to bedrock or to a cemented pan; available water capacity in the upper 40 inches; and content of salts, sodium, and sulfidic materials affect plant growth. Flooding; wetness; slope; stoniness; and amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

The “Sanitary Facilities” table shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. This table also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. Soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

Ratings are based on soil properties, site features, and observed soil performance. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock, or a cemented pan, interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a

nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

The “Sanitary Facilities” table gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. Ratings are based on soil properties, site features, and observed soil performance. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. Waste is spread, compacted, and covered daily with a thin layer of soil, excavated from the trench. When the trench is full, a final cover of soil material at least 2-feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. Waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2-feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ratings in the “Sanitary Facilities” table are based on soil properties, site features, and observed soil performance. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. Soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. Soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, the most organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They are also important when soil is used as a medium for treatment and disposal of organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

Use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area, then environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste; municipal sewage sludge; use of wastewater

for irrigation; and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available from local Natural Resources Conservation Service or Cooperative Extension Service offices.

Construction Materials

The “Construction Materials” table gives information about the soils as a source of roadfill, sand, gravel, and topsoil. Soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the “Construction Materials” table, soils are rated as a source of roadfill for low embankments, generally less than 6-feet high and less exacting in design than higher embankments.

Ratings are for soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The “Engineering Index Properties” table provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. Soil performance after it is stabilized with lime or cement is not considered in the ratings.

Ratings are based on soil properties, site features, and observed soil performance. Thickness of suitable material is a major consideration. Ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, slopes of more than 25 percent, or a water table at a depth of less than 1 foot. They may have layers of suitable material, but it is less than 3-feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the “Construction Materials” table, only the probability of finding material in suitable quantity in or below the soil is evaluated. Suitability of the material for specific purposes is not evaluated nor are factors that affect excavation of the material.

Properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), thickness of suitable material, and content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the “Engineering Index Properties” table.

A soil rated as a *probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3-feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable* source. Fragments of soft bedrock, such as shale and siltstone, are not considered sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Reclamation potential of the borrow area is also evaluated.

Toxic material and such properties as soil reaction, available water capacity, and fertility affect plant growth. Slope, the water table, rock fragments, soil texture, and thickness of suitable material affect ease of excavating, loading, and spreading. Slope, the water table, rock fragments, bedrock, and toxic material affect reclamation of the borrow area.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils; loamy soils that have a relatively high content of clay; soils that have only 20 to 40 inches of suitable material; soils that have an appreciable amount of gravel, stones, or soluble salts; or soils that have slopes of 8 to 15 percent. Soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey; have less than 20 inches of suitable material; have a large amount of gravel, stones, or soluble salts; have slopes of more than 15 percent; or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

The “Water Management” table gives information about soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. Limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. Seepage potential is determined by permeability of the soil and depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20-feet high, constructed to impound water or to protect land against overflow. In the “Water Management” table, soils are rated as a source of material for embankment fill. Ratings apply to soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

Ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material and trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil affect excavated ponds. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving affect excavating and grading and the stability of ditchbanks. Productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. Depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope affect the design and management of an irrigation system. Large stones and depth to bedrock or to a cemented pan affect the construction of a system. Depth of the root zone, the amount of salts or sodium, and soil reaction affect the performance of a system.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. Restricted rooting depth, severe hazard of soil blowing or water erosion, excessively coarse texture,

and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of a soil survey. Data and estimates of soil and water features, listed in the tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

Estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

The "Engineering Index Properties" table gives estimates of the engineering classification and of the range of index properties for major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. Soil series descriptions in Part I of this survey give the range in depth and information on other properties of each layer.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1988) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 based on grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 based on visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter and larger than 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area, or from nearby areas, and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

The “Physical Properties of the Soils” and “Chemical Properties of the Soils” tables show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

The following paragraphs describe the columns in the “Physical Properties of the Soils” table.

Depth to the upper and lower boundaries of each layer is indicated. Range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the largest to the smallest.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the “Physical Properties of the Soils” table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. Capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the

change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated based on the kind and amount of clay minerals in the soil and on measurements of similar soils.

Linear extensibility is used to determine the *shrink-swell potential* of soils. The shrink-swell potential is *low* if the soil has a linear extensibility of less than 3 percent, *moderate* if 3 to 6 percent, *high* if 6 to 9 percent, and *very high* if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design is often needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the “Physical Properties of the Soils” table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. It affects the available water capacity, infiltration rate, and tilth. Organic matter is a source of nitrogen and other nutrients for crops.

Erosion factors are shown in the “Physical Properties of the Soils” table as the K factor (K and Kf) and the T factor. *Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor K indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility of soils to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to soil blowing, or the tons per acre per year that can be expected to be lost to soil blowing. There is a close correlation between soil blowing and the size and durability of

surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence soil blowing.

The following paragraphs describe the columns in the “Chemical Properties of the Soils” table.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. Soils having a high cation-exchange capacity can retain cations. The ability to retain cations helps to prevent the pollution of ground water.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the soil. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is given as the percent, by weight, of hydrated calcium sulfates in the soil. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils that have a high content of gypsum (more than 10 percent) may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation; it is expressed, in millimhos per centimeter at 25 degrees C, as the electrical conductivity of the saturation extract. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by irrigation water quality and by water application frequency. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio is the measure of sodium relative to calcium and magnesium in the water extracted from saturated soil paste. Soils having a sodium adsorption ratio of 13 or more may be characterized by increased dispersion of organic matter and clay particles, reduced permeability and aeration, and general degradation of soil structure.

Water Features

The “Water Features” table gives estimates of several important water features used in land-use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. Soil properties affecting the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include depth to a seasonal high water table, intake rate, permeability after prolonged wetting, and depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. They consist chiefly of very deep, well-drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. They consist chiefly of moderately deep or deep, moderately well-drained or well-drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. They consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. They consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near

the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered ponding.

The “Water Features” table gives the frequency and duration of flooding and the time of the year when flooding is most likely to occur. *Frequency*, *duration*, and probable *months* of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year when flooding is most likely to occur is expressed in *months*. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered is local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6-inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the “Water Features” table are *water table depth, kind of water table*, and *months* of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time is allowed for adjustments in the surrounding soil.

Two numbers in the column, *water table depth*, indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates the water table is above the surface of the soil. *> than 6.0* indicates the water table is below a depth of 6 feet or it is within a depth of 6 feet for less than a month.

Soil Features

The “Soil Features” table gives estimates of several important soil features used in land-use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well-drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates the soil is rarely susceptible to formation of ice lenses; a *moderate* potential indicates the soil is susceptible to formation of ice lenses, resulting in frost heave and subsequent loss of soil strength; and a *high* potential indicates the soil is highly susceptible to formation of ice lenses, resulting in frost heave and subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The corrosion

rate of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The corrosion rate of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and soil acidity.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For *uncoated steel*, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For *concrete*, the risk of corrosion, also expressed as *low, moderate,* or *high,* is based on soil texture, acidity, and amount of sulfates in the saturation extract.

References

Alexander, R.R., 1966. Site indexes for lodgepole pine with corrections for stand density; instructions for field use. U.S. Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station Research Paper, RP-24.

Alexander, R.R., 1967. Site indexes for Engelmann spruce. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper, RP-32.

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1988. Standard test method for classification of soils for engineering purposes. ASTM Standard D 2487-00.

Baker, F.S. 1925. Aspen in the Central Rocky Mountain Region. United States Department of Agriculture Bulletin 1291.

Brickell, J.E. 1968. A method for constructing site index curves from measurements of tree age and height—Its application to inland Douglas-fir. U.S. Department of Agriculture, Forest Service, Intermountain Research Station Research Paper INT-RP-47.

Brown, P.L., and G.R. Carlson. 1990. Grain yields related to stored soil water and growing season rainfall. Montana Agricultural Experiment Station Special Report Number 35.

Dahms, W.G. 1964. Gross and net yield tables for lodgepole pine. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR, Research Paper PNW-8.

Meyer, W.H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Department of Agriculture, Technical Bulletin 630. Washington, DC.

Montana Agricultural Statistics Service. 1989. Montana Agricultural Statistics. County Statistics 1987-1988. Volume XXVI.

Montana Department of State Lands, Division of Forestry, and U.S. Department of Agriculture, Forest Survey, Intermountain Forest and Range Experiment Station. 1984. Timber resources of the Headwater Counties. Working Circle 3.

Myers, C.A. 1967. Yield tables for managed stands of lodgepole pine in Colorado and Wyoming. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper RM-RP-26.

O'Brien R.A., and D.C. Collins. 1991. Forest statistics for land outside national forests in West-Central Montana, 1989. U.S. Department of Agriculture, Intermountain Research Station Research Bulletin INT-RB-72.

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. U.S. Department of Agriculture, Forest Service, Intermountain Research Station General Technical Report INT-GTR-34.

Soil Survey Division Staff. 1962. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1998. Keys to soil taxonomy. 8th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

United States Department of Agriculture; Division of Soil Survey; Bureau of Plant Industry, Soils, and Agricultural Engineering. 1947. Soils of Lewis and Clark County: Soil Reconnaissance of Montana. In cooperation with the Montana State College, Agricultural Experiment Station, Department of Agronomy and Soils. Preliminary Report. Bulletin 445.

United States Department of Agriculture, Natural Resources Conservation Service. Montana Field Office Technical Guide, Section II. (http://www.nrcs.usda.gov/technical/efotg/)

United States Department of Agriculture, Natural Resources Conservation Service. National forestry handbook, title 190. (http://soils.usda.gov/technical/nfhandbook/)

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov/technical/handbook/)

United States Department of Agriculture, Soil Conservation Service. 1976. National range handbook. (http://www.glti.nrcs.usda.gov/technical/publications/nrph.html)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. (See Sodic (alkali) soil.)

Alluvial fan. A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hillslopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redox feature.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redox features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillite. Weakly metamorphosed mudstone or shale.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Avalanche chute. The track or path formed by an avalanche.

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular

to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding planes. Fine strata, less than 5-millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-floored plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of cobbles or gravel. In some blowouts, the water table is exposed.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Bouldery. Refers to a soil with .01 to 0.1 percent of the surface covered with boulders.

Bouldery soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments larger than 24 inches (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channeled. Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.

Channery soil material. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque. A semicircular, concave, bowl-like area that has steep faces primarily resulting from erosive activity of a mountain glacier.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey soil. Silty clay, sandy clay, or clay.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from the adjacent stands.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Closed depression. A low area completely surrounded by higher ground and having no natural outlet.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Codominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

COLE (coefficient of linear extensibility). (See Linear extensibility.)

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest. Forestland capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion. In areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to

compression. Terms describing consistence are defined in the “Soil Survey Manual” (Soil Survey Division Staff, 1962).

Consolidated sandstone. Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.

Consolidated shale. Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deep soil. A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Dominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well-drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet, at or near the surface, during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.

Even aged. Refers to a stand of trees in which only small differences in age occur between individual trees. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well-preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface profile is dominantly concave. In terms of gradational processes, a footslope is a transitional zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Giant ripple mark. The undulating surface sculpture produced in noncoherent granular materials by currents of water and by the agitation of water in

wave action during the draining of large glacial lakes, such as Glacial Lake Missoula.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciated uplands. Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Soil that is 15 to 35 percent, by volume, rounded or angular rock fragments up to 3 inches (7.6 centimeters) in diameter. Very gravelly soil is 35 to 60 percent gravel, and extremely gravelly soil is more than 60 percent gravel by volume.

Grazeable forestland. Land capable of sustaining livestock grazing by producing forage of sufficient quantity during one or more stages of secondary forest succession.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. A mineral consisting of hydrous calcium sulfate.

Habitat type. An aggregation of all land areas capable of producing similar climax plant communities.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual” (Soil Survey Division Staff, 1962). The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A or E horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame terrace. A terracelike ridge consisting of stratified sand and gravel that were deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

Krotovina. A filled faunal burrow—Irregular tubular streaks caused by the filling of tunnels made by burrowing animals in one layer with material from outside the layer. In a profile, they appear rounded or elliptical. Their textures and structures may be unlike those of the soil around them.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well-sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lateral moraine. A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking or by mass wasting.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $1/3$- or $1/10$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting

of iron oxide or manganese oxide generally are considered a type of redox concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microhigh. An area that is 2 to 12 inches higher than the adjacent microlow.

Microlow. An area that is 2 to 12 inches lower than the adjacent microhigh.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Miscellaneous water. A sewage lagoon, an industrial waste pit, a fish hatchery, or a similar water area.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Areas of color that differ from the matrix color. These colors are commonly attributes retained from the geologic parent material. (See Redox features for indications of poor aeration and impeded drainage.)

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well-decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Naturalized pasture. Forestland that is used primarily for the production of forage for grazing by livestock rather than for the production of wood products. Overstory trees are removed or managed to promote the native and introduced understory vegetation occurring on the site. This vegetation is managed for its forage value through the use of grazing management principles.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Overstory. The trees in a forest that form the upper crown cover.

Oxbow. The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile.

Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit. The range of moisture content within which the soil remains plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential natural community (PNC). The biotic community that would become established on an ecological site if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in its development. The PNC may include acclimatized or naturalized nonnative species.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Quartzite, metamorphic. Rock consisting mainly of quartz that formed through recrystallization of quartz-rich sandstone or chert.

Quartzite, sedimentary. Very hard but unmetamorphosed sandstone consisting chiefly of quartz grains.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. (See Similarity index.)

Range site. (See Ecological site.)

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Recessional moraine. A moraine formed during a temporary but significant halt in the retreat of a glacier.

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redox concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redox depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redox features. Redox concentrations, redox depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redox feature.

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relict stream terrace. One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Riser. The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, boulders, stones, cobbles, and gravel.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Rubble land. Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of

cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salinity. The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline	0 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Sedimentary plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sedimentary uplands. Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

Seepage (in tables). The movement of water through soil. Seepage adversely affects the specified use.

Semiconsolidated sedimentary beds. Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shelterwood system. A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid regeneration of the more intolerant tree species in a stand.

Shoulder. The uppermost inclined surface at the top of a hillside. It is the transitional zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Similarity index. A similarity index is the percentage of a specific vegetation state plant community that is presently on the site.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is loamy or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The

degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with tillage, or stones cover .01 to 0.1 percent of the surface. Very stony means that 0.1 to 3.0 percent of the surface is covered with stones. Extremely stony means that 3 to 15 percent of the surface is covered with stones.

Stony soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Strath terrace. A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that is restrictive to roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tailwater. The water directly downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Terracette. Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may or may not be induced by trampling of livestock such as sheep or cattle.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive, nearly level to gently rolling or moderately sloping area that is underlain by or consists of till and that has a slope of 0 to 8 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Tread. The relatively flat terrace surface that was cut or built by stream or wave action.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded

glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water-spreading. Diverting runoff from natural channels by means of a system of dams, dikes, or ditches and spreading it over relatively flat surfaces.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

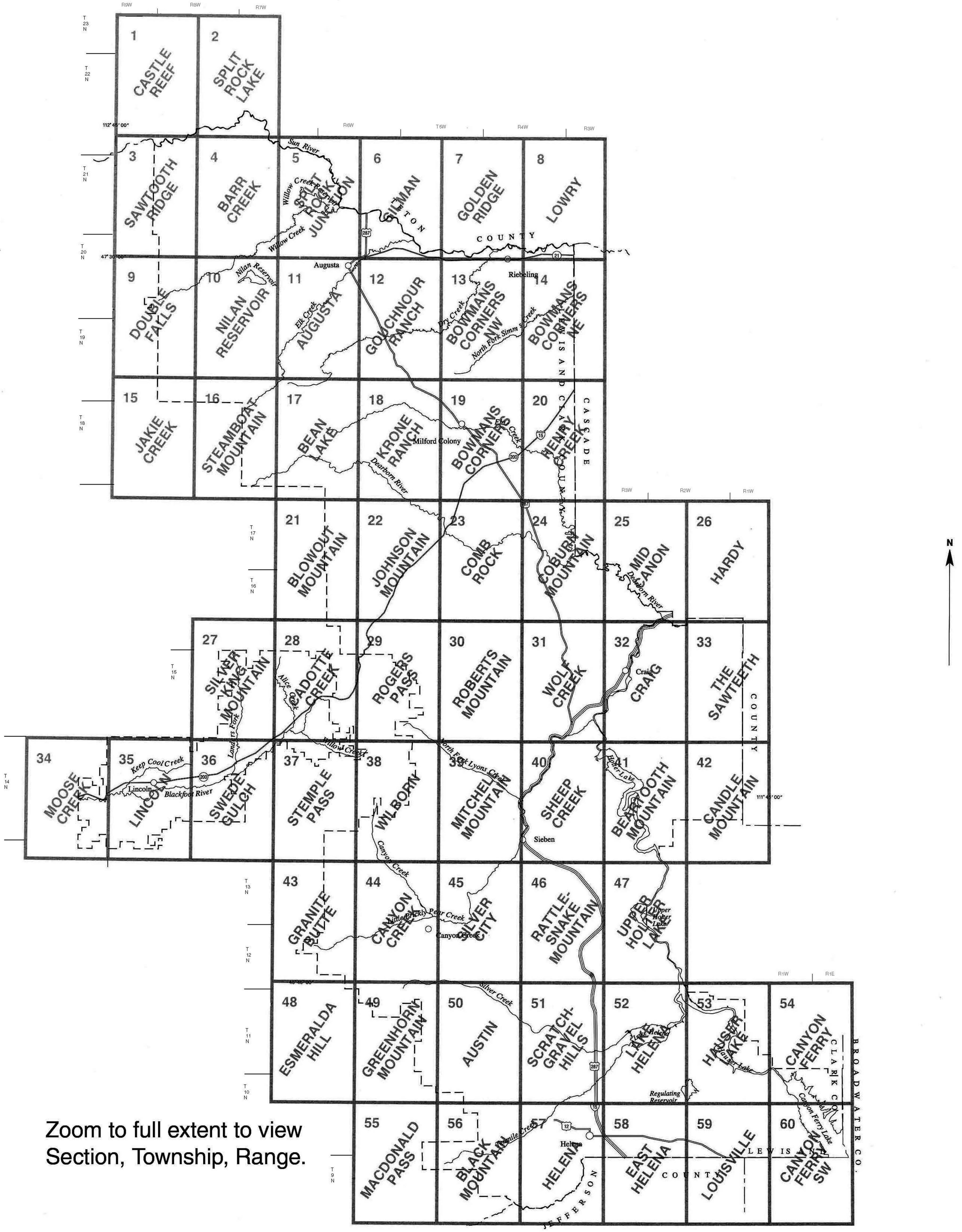
Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.



INDEX TO MAP SHEETS

LEWIS AND CLARK COUNTY AREA, MONTANA

Scale 1:253440

MILES

KILOMETERS

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

The publication symbols consist of field symbols. Symbols consist of numbers or a combination of numbers and letters, for example, 18A, 266D, 2, and 1823F. For the symbols designated by a number and a letter, the number designates the soil type and the letter designates the slope class. The symbols without a number designate a miscellaneous area. Map units are arranged numerically by publication symbols.

SYMBOL	NAME
1B	Aridic Ustifluvents, 0 to 4 percent slopes
2A	Larry silt loam, cool, 0 to 2 percent slopes
3A	Fairway silt loam, cool, 0 to 2 percent slopes
4B	Silvercity gravelly loam, 1 to 4 percent slopes
5B	Stady-Wabek complex, 1 to 4 percent slopes
6A	Totelake gravelly loam, 0 to 3 percent slopes
7A	Silverking silt loam, 0 to 3 percent slopes
8A	Stryker silt loam, cool, 0 to 2 percent slopes
9A	Scravo gravelly loam, 0 to 2 percent slopes
12A	Korell loam, 0 to 2 percent slopes, rarely flooded
13B	Stady silt loam, cool, 1 to 4 percent slopes
15E	Worock-Mikesell stony loams, 8 to 35 percent slopes
16B	Gerdrum-Nobe-Yamacall complex, 0 to 4 percent slopes
17A	Havre silt loam, 0 to 2 percent slopes
19E	Worock stony loam, 8 to 35 percent slopes
19F	Worock stony loam, 35 to 60 percent slopes
20A	Fairway silt loam, 0 to 2 percent slopes
23E	Hanson channery loam, 8 to 35 percent slopes
24A	Yamacall silt loam, 0 to 2 percent slopes
24C	Yamacall silt loam, 2 to 8 percent slopes
25F	Tolex-Mocmont-Rock outcrop complex, cool, 25 to 60 percent slopes
26C	Brocko silt loam, 2 to 8 percent slopes
26D	Brocko silt loam, 8 to 15 percent slopes
27F	Mocmont-Bignell-Tolex very stony loams, 25 to 60 percent slopes
33B	Sappington-Amesha loams, 1 to 4 percent slopes
33C	Sappington-Amesha loams, 4 to 8 percent slopes
34B	Sieben gravelly loam, 2 to 8 percent slopes
39B	Chinook sandy loam, 2 to 8 percent slopes
40D	Rock outcrop-Rubble land
41C	Rootel-Musselshell loams, 2 to 8 percent slopes
42B	Fairfield cobbly loam, 1 to 4 percent slopes
43A	Niart loam, 0 to 3 percent slopes
61E	Holter-Castner channery loams, 8 to 45 percent slopes
63D	Mocmont-Tolex complex, 8 to 25 percent slopes
63F	Mocmont-Tolex complex, 25 to 60 percent slopes
64D	Windham channery loam, 4 to 15 percent slopes
69A	Farnuf loam, 0 to 2 percent slopes
69B	Farnuf loam, 2 to 4 percent slopes
69C	Farnuf loam, 4 to 10 percent slopes
71E	Sawbuck loam, 15 to 45 percent slopes
73D	Bridger loam, 4 to 25 percent slopes
77F	Whitore-Tropal very channery loams, 25 to 60 percent slopes
80C	Regent clay loam, 2 to 10 percent slopes
84E	Mocmont-Tolex complex, cool, 8 to 25 percent slopes
84F	Mocmont-Tolex complex, cool, 25 to 60 percent slopes
85E	Whitecow channery loam, 8 to 35 percent slopes
85F	Whitecow channery loam, 35 to 60 percent slopes
86F	Comad extremely stony sandy loam, 25 to 45 percent slopes
88B	Shawa loam, 2 to 8 percent slopes
89D	Geohrock channery loam, cool, 4 to 25 percent slopes
90F	Elve extremely stony sandy loam, 25 to 60 percent slopes
91B	Cadotte gravelly loam, 0 to 4 percent slopes
93E	Libeg-Cheadle very channery loams, 15 to 45 percent slopes
95E	Rittel-Tolex complex, 15 to 35 percent slopes
96E	Swiftcurrent loam, 8 to 35 percent slopes
96F	Swiftcurrent loam, 35 to 65 percent slopes
100E	Hilger extremely stony loam, 8 to 45 percent slopes
112A	Korell loam, 0 to 2 percent slopes, protected
115A	Neen silt loam, 0 to 2 percent slopes
116B	Yamacall-Gerdrum complex, 0 to 4 percent slopes
117A	Ryell-Rivra complex, 0 to 3 percent slopes
119E	Worock stony loam, warm, 8 to 35 percent slopes
122A	Binvar cobbly loam, 0 to 2 percent slopes
123E	Hanson-Starley channery loams, 15 to 45 percent slopes
130A	Kobase silty clay, 0 to 2 percent slopes
136B	Amesha silt loam, 1 to 3 percent slopes
136C	Rothiemay silt loam, 2 to 8 percent slopes
137A	Binna-Ashlo complex, 0 to 2 percent slopes
137B	Musselshell-Crago complex, 2 to 8 percent slopes
138D	Crittenden-Tolman complex, 4 to 35 percent slopes
139D	Brocko-Chinook complex, 8 to 35 percent slopes
141E	Crago-Pensore channery loams, 15 to 45 percent slopes
146C	Megonot silty clay, 4 to 8 percent slopes
149D	Megonot-Weingart complex, 8 to 35 percent slopes
154D	Shawmut-Beaverton very gravelly loams, 8 to 25 percent slopes
160D	Castner-Blaincreek-Rock outcrop complex, 4 to 35 percent slopes
161E	Shawa-Castner-Rock outcrop complex, 8 to 45 percent slopes
163D	Geohrock-Tolman channery loams, 4 to 35 percent slopes
164E	Windham-Lap channery loams, 8 to 45 percent slopes
167C	Shawmut gravelly loam, 2 to 8 percent slopes
169C	Farnuf-Reeder loams, 4 to 10 percent slopes
171E	Sawbuck-Tolex complex, 15 to 45 percent slopes
177F	Tropal-Rock outcrop complex, 25 to 60 percent slopes
178D	Regent-Reeder-Work stony loams, 4 to 30 percent slopes
180D	Regent-Castner complex, 8 to 35 percent slopes
184E	Mocmont very channery loam, cool, 15 to 35 percent slopes
185E	Whitore-Helmville channery loams, 15 to 35 percent slopes
185F	Whitore-Helmville channery loams, 35 to 60 percent slopes
188C	Perma gravelly loam, 2 to 15 percent slopes
190F	Shadow-Cowood complex, 25 to 60 percent slopes
195F	Typic Haplustepts-Tolex complex, 25 to 60 percent slopes
196F	Helmville-Swiftcurrent complex, 25 to 60 percent slopes
201B	Fluvaquents, saline, 0 to 4 percent slopes
206A	Nippt very cobbly loam, 0 to 4 percent slopes
209A	Thess loam, 0 to 2 percent slopes
212A	Ryell loam, 0 to 2 percent slopes
215E	Bignell very stony loam, 8 to 35 percent slopes
217A	Havre silty clay, 0 to 2 percent slopes
218A	Meadowcreek-Fairway complex, 0 to 2 percent slopes
219E	Worock, warm-Libeg stony loams, 8 to 35 percent slopes
232B	Nippt-Geohrock gravelly loams, 2 to 4 percent slopes
233C	Geohrock-Crago very cobbly loams, 2 to 8 percent slopes
236B	Kalsted-Chinook sandy loams, 2 to 8 percent slopes
238B	Assinniboine-Chinook sandy loams, 2 to 8 percent slopes
239C	Vebar-Cuniff fine sandy loams, 2 to 8 percent slopes
241F	Pensore-Rock outcrop complex, 15 to 60 percent slopes
243C	Sieben stony loam, 2 to 15 percent slopes
254A	Silvercity-Wabek gravelly loams, 0 to 3 percent slopes
257D	Delpoint-Cabbart loams, 8 to 35 percent slopes
260D	Blaincreek-Castner gravelly loams, 4 to 25 percent slopes
263E	Hauz-Sieben-Tolman channery loams, 8 to 45 percent slopes
264F	Lap-Windham-Rock outcrop complex, 15 to 45 percent slopes
271F	Sawbuck-Sawbuck, shale substratum, loams, 25 to 60 percent slopes
277F	Warneke-Rock outcrop complex, 15 to 60 percent slopes
278C	Regent-Auchard loams, 2 to 8 percent slopes
280D	Reeder-Regent-Castner complex, 8 to 25 percent slopes
285F	Whitecow, cool-Trapps, dry channery loams, 25 to 60 percent slopes
286E	Woodgulch-Elbeth-Rock outcrop complex, 8 to 35 percent slopes
288C	Frenchcreek very gravelly loam, 2 to 15 percent slopes
290E	Tigeron very cobbly loam, 15 to 35 percent slopes
290F	Stemple-Tigeron very channery loams, 30 to 60 percent slopes
296F	Mikesell-Swiftcurrent loams, 25 to 60 percent slopes
299D	Leavitt-Libeg stony loams, 4 to 30 percent slopes
300	Dumps, mine
301B	Typic Ustifluvents, 0 to 4 percent slopes
306A	Nippt-Attewan-Beaverell complex, 0 to 4 percent slopes
308A	Villy silt loam, 0 to 2 percent slopes
309A	Thess-Scravo complex, 0 to 2 percent slopes
339D	Cuniff-Rock outcrop complex, 2 to 35 percent slopes
341D	Musselshell-Crago-Pensore complex, 4 to 25 percent slopes
343D	Beanlake-Winspect stony loams, dry, 2 to 25 percent slopes
343D	Beanlake-Winspect stony loams, dry, 2 to 25 percent slopes
357D	Delpoint-Marmarth-Tolman complex, 8 to 25 percent slopes
360F	Castner-Holter-Rock outcrop complex, 15 to 60 percent slopes
363F	Tolman-Rock outcrop complex, 15 to 60 percent slopes
380C	Reeder-Regent-Cabba loams, 2 to 8 percent slopes
380D	Reeder-Regent-Cabba loams, 8 to 25 percent slopes
382C	Marmarth-Delpoint loams, 2 to 8 percent slopes
384E	Mocmont-Tolex-Hilger very stony loams, 15 to 45 percent slopes
385E	Whitecow-Tolex channery loams, 8 to 35 percent slopes
386E	Peeler stony sandy loam, 15 to 45 percent slopes
390F	Helmville channery loam, 25 to 60 percent slopes
406A	Nippt gravelly loam, 0 to 2 percent slopes
408A	Villard-Villy silt loams, 0 to 2 percent slopes
413A	Attewan loam, 0 to 2 percent slopes
415D	Crow loam, 4 to 25 percent slopes
417A	Turrah silty clay, 0 to 2 percent slopes
433E	Crago-Musselshell gravelly loams, 4 to 35 percent slopes
437C	Musselshell-Sappington loams, 2 to 8 percent slopes
441E	Whitecow-Crago-Pensore channery loams, 8 to 35 percent slopes
443E	Winspect-Cabba-Wayden complex, 8 to 35 percent slopes
457C	Delpoint-Amesha loams, 2 to 8 percent slopes
463F	Rock outcrop-Tolex complex, 25 to 80 percent slopes
465A	Beaverell-Ashlo very cobbly loams, 0 to 2 percent slopes
479E	Regent-Wayden-Cabba complex, 15 to 45 percent slopes
480D	Reeder-Castner complex, 4 to 25 percent slopes
484F	Trapps channery loam, 25 to 60 percent slopes
486F	Peeler-Rock outcrop complex, 15 to 60 percent slopes
499D	Farnuf-Hilger stony loams, cool, 4 to 25 percent slopes
500	Pits, gravel
501B	Fluvaquents-Fluvaquentic Haplustolls complex, 0 to 4 percent slopes
505A	Vanda silty clay, 0 to 3 percent slopes
506A	Nippt-Attewan complex, 0 to 2 percent slopes
508A	Soapcreek silty clay, 0 to 2 percent slopes
513A	Attewan-Nippt complex, 0 to 2 percent slopes
514B	Weingart-Assinniboine complex, 2 to 8 percent slopes
515E	Mikesell stony loam, 8 to 35 percent slopes
520A	Fairway-Villy silt loams, 0 to 2 percent slopes
532B	Geohrock gravelly loam, 2 to 8 percent slopes
533B	Sappington-Musselshell gravelly loams, 2 to 8 percent slopes
543D	Beanlake-Winspect stony loams, 4 to 25 percent slopes
544A	Work-Farnuf complex, 0 to 2 percent slopes
544C	Work-Farnuf complex, 2 to 10 percent slopes
551B	Beaverton very cobbly loam, 0 to 4 percent slopes
556D	Lihen-Chinook complex, 2 to 35 percent slopes
557F	Delpoint-Cabbart-Rock outcrop complex, 15 to 60 percent slopes
563E	Tolex-Tolman-Hauz channery loams, 8 to 45 percent slopes
567B	Hilger stony loam, 2 to 8 percent slopes
567D	Hilger-Farnuf stony loams, 8 to 35 percent slopes
569A	Yamacall-Attewan loams, 0 to 2 percent slopes
579E	Wayden-Cabba-Rock outcrop complex, 15 to 60 percent slopes
580E	Reeder-Castner-Rock outcrop complex, 8 to 45 percent slopes
582C	Burgraff-Cabbart complex, 2 to 8 percent slopes
584D	Trapps stony loam, 8 to 25 percent slopes
590E	Helmville channery loam, warm, 15 to 30 percent slopes
590F	Helmville channery loam, warm, 30 to 60 percent slopes
593E	Libeg-Cheadle-Rock outcrop complex, 15 to 45 percent slopes
600	Riverwash
601B	Typic Ustifluvents-Fluvaquentic Haplustolls complex, 0 to 4 percent slopes
609A	Slategoat silt loam, 0 to 2 percent slopes
614B	Weingart clay loam, 2 to 8 percent slopes
637B	Crago gravelly loam, 0 to 8 percent slopes
643D	Fairfield-Beanlake-Winspect stony loams, 2 to 25 percent slopes
644C	Work stony loam, 2 to 15 percent slopes
651B	Beaverton very stony sandy loam, 0 to 4 percent slopes
663E	Tolex channery loam, 8 to 35 percent slopes
664E	Windham-Whitecow-Lap channery loams, 15 to 45 percent slopes
679E	Wayden-Cabba-Regent complex, 15 to 45 percent slopes
680E	Owen Creek-Cheadle complex, 15 to 45 percent slopes
684F	Mocmont-Tolex complex, moist, 30 to 60 percent slopes
685F	Whitecow channery loam, cool, 25 to 60 percent slopes
690F	Stemple-Tigeron-Cowood very channery loams, dry, 30 to 60 percent slopes
700D	Bridger silt loam, moderately wet, 4 to 25 percent slopes
701B	Fluvaquents-Endoaquolls complex, 0 to 4 percent slopes
714B	Weingart-Musselshell complex, 2 to 8 percent slopes
738B	Crittenden-Kalsted, bedrock substratum, sandy loams, 2 to 8 percent slopes
743D	Regent-Fairfield-Winspect stony loams, 8 to 35 percent slopes

SOIL LEGEND

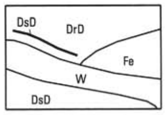
The publication symbols consist of field symbols. Symbols consist of numbers or a combination of numbers and letters, for example, 18A, 266D, 2, and 1823F. For the symbols designated by a number and a letter, the number designates the soil type and the letter designates the slope class. The symbols without a number designate a miscellaneous area. Map units are arranged numerically by publication symbols.

SYMBOL	NAME
744C	Work cobbly clay loam, 2 to 8 percent slopes
751B	Beaverton-Shawmut very gravelly loams, 1 to 4 percent slopes
761C	Baxendale-Castner complex, 4 to 15 percent slopes
763E	Tolex-Holter-Castner channery loams, 8 to 45 percent slopes
779E	Sinnigam-Regent complex, 15 to 45 percent slopes
780E	Regent-Sinnigam complex, 8 to 35 percent slopes
784D	Yourame stony loam, 8 to 35 percent slopes
785F	Whitore, dry-Tropal complex, 25 to 45 percent slopes
790E	Stemple-Tigeron very channery loams, cool, 8 to 30 percent slopes
790F	Stemple-Tigeron very channery loams, cool, 30 to 60 percent slopes
793F	Cowood-Rock outcrop complex, 25 to 60 percent slopes
808A	Villy silt loam, 0 to 2 percent slopes, very rarely flooded
833E	Winspect, dry-Cabbart complex, 15 to 45 percent slopes
844C	Work clay loam, 2 to 8 percent slopes
851A	Beaverell gravelly loam, 0 to 2 percent slopes
861D	Shawa-Farnuf-Castner complex, 4 to 25 percent slopes
863E	Castner-Tolex-Rock outcrop complex, 8 to 60 percent slopes
879E	Regent-Wayden complex, 8 to 35 percent slopes
880E	Owen Creek loam, 15 to 45 percent slopes
884F	Beartooth-Whitecow, cool-Warneke, cool complex, 25 to 60 percent slopes
885F	Whitecow-Warneke channery loams, 15 to 45 percent slopes
890F	Tigeron very gravelly loam, cool, 35 to 60 percent slopes
893F	Cowood-Cheadle-Rock outcrop complex, 25 to 60 percent slopes
944B	Len cobbly loam, 1 to 8 percent slopes
951A	Beaverell very gravelly loam, 0 to 2 percent slopes
961E	Hilger-Regent-Castner stony loams, 15 to 35 percent slopes
963F	Tolex-Mocmont-Rock outcrop complex, 25 to 60 percent slopes
979E	Regent-Lap complex, 8 to 45 percent slopes
980E	Owen Creek-Bridger stony loams, 15 to 35 percent slopes
984F	Trapps-Warneke channery loams, 25 to 60 percent slopes
985F	Trapps-Whitecow-Warneke channery loams, 25 to 60 percent slopes
DAM	Dam
LF	Landfill
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

SOIL SURVEY FEATURES

SOIL DELINEATIONS AND SYMBOLS



Clay spot

Escarpment, bedrock

Gravel pit

Gravelly spot

Mine or quarry

Perennial water

Rock outcrop

Saline spot

Short steep slope

Sodic spot

Spoil area

Stony spot

Very stony spot

Wet spot

CULTURAL FEATURES

BOUNDARIES

County or parish

Reservation (national or state forest or park)

Limit of soil survey (label)

Map sheet neatline

Public land survey system section boundary

ROAD EMBLEMS & DESIGNATIONS

Interstate

Federal

State

Symbol Definitions

LABEL	NAME	DESCRIPTION
❊	Clay spot	A spot where the surface texture is silty clay or clay in areas where the surface layer is sandy loam, loam, silt loam, or coarser. Typically less than 5 acres.
▾▾▾▾▾▾▾▾▾▾	Escarpment, bedrock	A relatively continuous and steep slope or cliff, which was produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.
⚔	Gravel pit	An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel. Typically less than 5 acres.
∴	Gravelly spot	A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area of surrounding soil with less than 15 percent fragments. Typically less than 5 acres.
⚒	Mine or quarry	An open excavation from which soil and underlying material are removed, exposing the bedrock. Also used to denote surface openings to underground mines. Typically less than 5 acres.
⊙	Perennial water	Small, natural or constructed lake, pond, or pit that contains water most of the year. Typically less than 5 acres.
∨	Rock outcrop	An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit. Typically less than 5 acres.
+	Saline spot	An area where the surface layer has an electrical conductivity (EC) of 8 mmhos cm-1 more than the surface layer of the named soils in the surrounding map unit, which have an EC of 2 mmhos cm-1 or less. Typically 1 to 2 acres.
·········	Short, steep slope	Narrow soil area that has slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.
⌀	Sodic spot	An area where the surface layer has a sodium adsorption ratio that is at least 10 more than the surface layer of the named soils in the surrounding map unit, which have a sodium adsorption ratio of 5 or less. Typically less than 5 acres.
≡	Spoil area	A pile of earthy materials, smoothed or uneven, resulting from human activity. Typically less than 5 acres.
o	Stony spot	A spot where 0.01 to 0.10 percent of the surface cover is rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has no surface stones. Typically 1 to 2 acres.
ꝏ	Very stony spot	A spot where 0.1 to 3.0 percent of the surface cover is rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has less than 0.01 percent of a surface cover of stones. Typically 1 to 2 acres.
ѱ	Wet spot	A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit. Typically less than 5 acres.